# The American Journal of Surgery

THURSTON SCOTT WELTON, M.D., *Editor*

*Associate Editors*
Bradley L. Coley, M.D., Arnold S. Jackson, M.D.,
E. Eric Larson, M.D.

*Obstetric Clinic*

Pelvic Tumors

December 1952

SIXTY-FIRST YEAR OF PUBLICATION

EDITORIAL BOARD

# The American Journal of Surgery

*Editor* THURSTON SCOTT WELTON, *New York*

*Associate Editors* BRADLEY L. COLEY, *New York* · ARNOLD S. JACKSON, *Madison* · E. ERIC LARSON, *Los Angeles*

ADVISORY BOARD

CLAUDE S. BECK, *Cleveland*
CLARENCE J. BERNE, *Los Angeles*
GEORGE R. BRIGHTON, *New York*
MEREDITH F. CAMPBELL, *New York*
JAMES T. CASE, *Santa Barbara*
RANDOLPH LEE CLARK, JR., *Houston*
ISIDORE COHN, *New Orleans*
FREDERICK A. COLLER, *Ann Arbor*
PAUL C. COLONNA, *Philadelphia*
GORDON S. FAHRNI, *Vancouver*
HERBERT C. FETT, *Brooklyn*
EMIL GOETSCH, *Brooklyn*
CHARLES A. GORDON, *Brooklyn*
DONALD GUTHRIE, *Sayre, Pa.*
LOUIS J. HIRSCHMAN, *Detroit*
EMILE F. HOLMAN, *San Francisco*
CLAUDE J. HUNT, *Kansas City, Mo.*
THOMAS J. KIRWIN, *New York*
*New York*, ARTHUR KRIDA
*Chicago*, WALTER G. MADDOCK
*New Orleans*, URBAN MAES
*Newark*, HARRISON S. MARTLAND
*New Orleans*, RUDOLPH MATAS
*St. Louis*, CARL A. MOYER
*Toronto*, D. W. GORDON MURRAY
*San Francisco*, H. C. NAFFZIGER
*Baltimore*, EMIL NOVAK
*Newark*, CLARENCE R. O'CROWLEY
*Boston*, LOUIS E. PHANEUF
*Rochester, Minn.*, JAMES T. PRIESTLEY
*Raleigh*, HUBERT A. ROYSTER
*Philadelphia*, HENRY S. RUTH
*Memphis*, ROBERT L. SANDERS
*Baltimore*, GRANT E. WARD
*Woodland, Calif.*, J. HOMER WOOLSEY

*The American Journal of Surgery is published monthly, by The American Journal of Surgery, Inc., 49 West 45th Street, New York 36, N. Y. Yearly Subscription, $12.00 U. S. A.; $13.00 Canada and Pan-American Countries; $15.00 Foreign. Single Numbers $2.00; Special Numbers $4.00. Reentered as second class matter February 7, 1951, at the Post Office, New York, N. Y. and on February 7, 1951, at York, Pa., under the act of March 3, 1879. December 1952—New Series, Volume LXXXIV, No. 6.* *Copyright, 1952, by The American Journal of Surgery, Inc.*

*Change of address must reach us one month preceding month of issue.*

NEW

*prompt . . . prolonged . . .*

*prescribed relief of pain*

# APAMIDE

BRAND • TRADEMARK

*tablets*

(N-acetyl-p-aminophenol, 0.3 Gm.)

***analgesic-antipyretic***

*rapid, direct analgesia*

*Apamide* quickly relieves pain and reduces fever through direct analgesic-antipyretic action. It avoids the delay inherent in compounds that require metabolic transformation to produce analgesia.

*prolonged relief of pain*

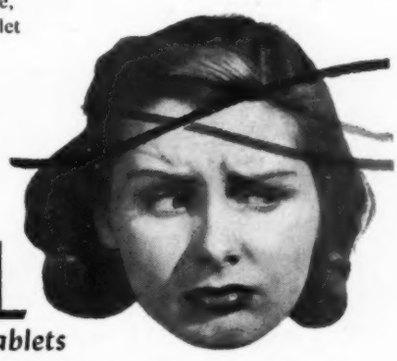
*Apamide* goes to work fast. It raises the pain threshold substantially within 30 minutes, reaches peak effect in about 2½ hours and continues to be effective for approximately 4 hours.

*well-tolerated analgesic*

*Apamide* is a pure, active agent that does not produce extraneous, possibly toxic metabolites. High dosages over long periods have not been shown to cause toxic reactions or gastric upsets. It is extremely valuable in patients who cannot tolerate salicylates.

℞ *only*

Available only on your prescription, *Apamide* permits precise control of dosage and duration of treatment *by you*. Prescribe it for relief of pain and reduction of fever in respiratory infections, functional headache, muscular or joint pain and dysmenorrhea. Average adult dose, 1 tablet every four hours.



***for a sedative-analgesic***

***prescribe***

# APROMAL

BRAND • TRADEMARK

*tablets*

(N-acetyl-p-aminophenol, 0.15 Gm. and acetylcarbromal, 0.15 Gm.)

***non-narcotic, non-barbiturate***

*Apromal* is especially valuable in those cases where pain coexists with tension, anxiety, restlessness, excitement, nervousness and irritability. *Apromal* contains Apamide and the widely used, gentle daytime sedative, acetylcarbromal. Enhancement of both analgesia and sedation is secured by this combination. Average adult dose, 1 tablet every 4 hours.

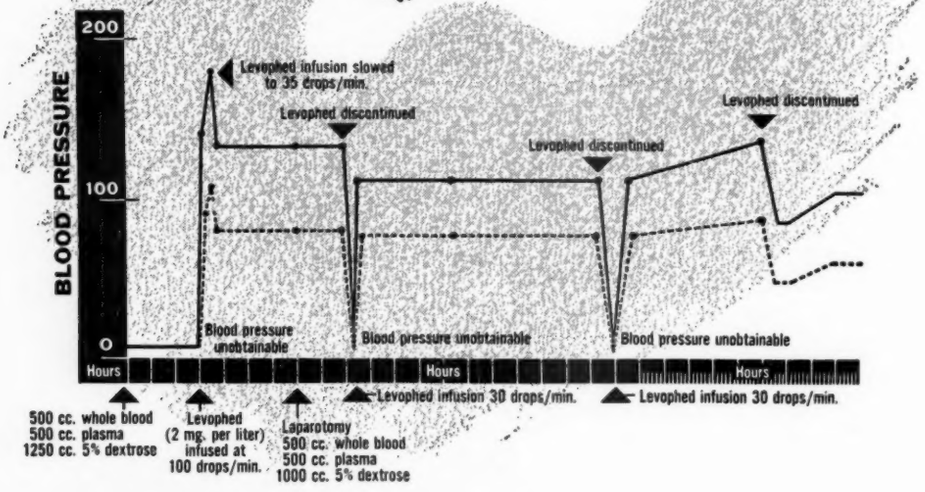
**AMES**

**COMPANY, INC., ELKHART, INDIANA** AMES **Ames Company of Canada, Ltd., Toronto**

43352

*New..*

## The Most Powerful Pressor Antidote for SHOCK




# LEVOPHED®

**BRAND OF LEVO-ARTERENOL (NOR-EPINEPHRINE)**

*Prompt, Predictable, Reliable, Easily Controlled Action*

Clinical experience with Levophed has demonstrated the dramatic, often life-saving action of the drug.

Levophed is indicated for the elevation and maintenance of blood pressure during all stages of shock, including profound, advanced, prolonged and so-called "irreversible" shock, as well as other acute hypotensive states associated with surgical and non-surgical trauma, hemorrhage, disease and central vasomotor depression.

SUPPLIED: Levophed solution 1:1000 in ampuls of 4 cc. (boxes of 10), to be administered in 1000 cc. of infusion fluid.

*Write for pamphlet giving a detailed discussion of clinical experience with Levophed and its manner of use.*

*Winthrop-Stearns* INC.
NEW YORK 18, N. Y. WINDSOR, ONT.

Levophed, trademark reg. U. S. & Canada

# The American Journal of Surgery

VOL. LXXXIV — Contents • December, 1952 — NUMBER SIX


## Editorial


THE VALUE OF TRAVEL . . . . . *Arnold S. Jackson* 625


## Original Articles


EARLY DIAGNOSIS AND PREVENTION OF POSTOPERATIVE THROMBOEMBOLISM . *Paul M. Neuda* 627

Presentation of certain blood changes which appear spontaneously following major operations and which suggest the possibility of a rising tendency to thrombosis. Pulmonary embolism is discussed, with prophylaxis.

VENOUS MESENTERIC THROMBOSIS. SUGGESTED ETIOLOGY AND CASE REPORT. . . . . *John Storer, Philip Kazdan and Joseph L. Bilton* 636

The authors give a résumé of mesenteric venous thrombosis, a clinical entity. The report of a case of mesenteric venous thrombosis with chronic recurrent pancreatitis ending fatally with pulmonary embolus is presented.

EVALUATION OF THE BOLEN BLOOD PATTERN TEST FOR DETECTING CANCER . . . . . *Arkell M. Vaughn, Wesley R. T. Metzner and Cornelius M. Annan* 641

The authors conclude the Bolen test cannot be verified as a good laboratory procedure for detecting early cancer, but it may be useful as a simple technic, as an adjunct in evaluating "clinical cures."

HERNIATED CERVICAL DISC. A NEW FORM OF TRACTION THERAPY . *Bernard D. Judovich* 646

A new method of motorized intermittent traction in herniated cervical disc is presented. The clinical results have been satisfactory as compared with conventional traction methods. Differential diagnosis and clinical examination in brachial plexus pain are discussed. Results in a series of sixty cases.

POSTOPERATIVE ANALYSIS OF 366 CONSECUTIVE CASES OF HERNIATED LUMBAR DISCS . . *Paul Ross and Franklin Jelsma* 657

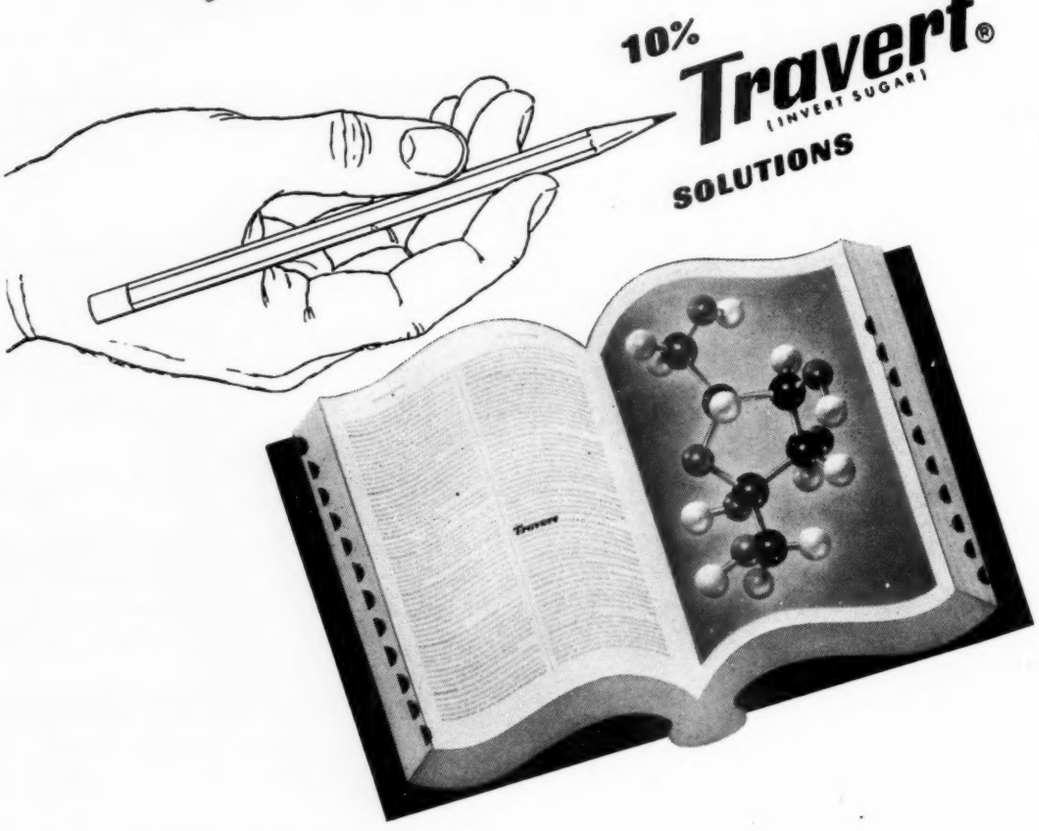
An analysis is presented of 366 consecutive cases of herniated discs, with a discussion of diagnosis from the standpoint of history and neurologic examination.

STUDIES ON 5-AMINOACRIDINE IN EXPERIMENTAL APPENDICEAL PERITONITIS . . . . . *Paul Nemir, Jr., H. H. Zinsser, H. A. Beaudet and H. R. Hawthorne* 663

Previously, studies on the *in vitro* effectiveness of 5-aminoacridine against the organisms usually found in peritonitis indicated that this agent was equally or more effective than penicillin, streptomycin, sulfadiazine or a combination of these drugs. This paper is concerned with this drug as a useful adjunct in the treatment of peritonitis when given parenterally and when administered to animals having fulminating peritonitis.


*Contents Continued on Page 5*

# Today's Word for greater Carbohydrate Alimentation . . .




***for twice the calories of 5% Dextrose***

***in equal infusion time***

***with no increase in fluid volume or vein damage***

With ***10% Travert*** solutions, a patient's carbohydrate needs can be more nearly satisfied within a reasonable time with no increase in fluid volume or vein damage.

***Travert*** solutions are sterile, crystal-clear, colorless, non-pyrogenic, and non-antigenic. They are prepared by the hydrolysis of cane sugar and are composed of equal parts of D-glucose (dextrose) and D-fructose (levulose).

***Travert*** solutions are available in water or saline in 150 cc., 500 cc., 1000 cc. sizes. For the treatment of potassium deficiency, ***10% Travert*** solutions with 0.3% potassium chloride are also available in 1000 cc. containers.

***Travert*** *is a trademark of* BAXTER LABORATORIES, INC.

*products of*

**BAXTER LABORATORIES, INC.**

Morton Grove, Illinois • Cleveland, Mississippi

DISTRIBUTED AND AVAILABLE ONLY IN THE 37 STATES EAST OF THE ROCKIES (except in the city of El Paso, Texas) THROUGH

**AMERICAN HOSPITAL SUPPLY CORPORATION**

GENERAL OFFICES • EVANSTON, ILLINOIS

# The American Journal of Surgery

Reg. U. S. Pat. Off., Nov. 3 1936

VOL. LXXXIV — Contents • December, 1952 — NUMBER SIX



SOME UNCOMMON CAUSES OF APPENDICEAL MUCOCELE . . . . . *John R. Hilsabeck, Lewis B. Woolner and Edward S. Judd, Jr.* 670

The authors' thesis is that in the absence of marked intraluminal contamination a mucocele of the appendix may be formed whenever the rate of appendiceal secretion exceeds the rate of absorption and proximal drainage.

SOME PATHOLOGIC ASPECTS OF CUTANEOUS WOUND HEALING . . . *Wallace Marshall* 675

A review of the highlights which have to do with the normal components of wound healing. Possible etiology and treatment of keloids.

POSTOPERATIVE WOUND DISRUPTION . . . *William P. Kleitsch and Dale W. Douglas* 678

A résumé of the causes of postoperative wound disruption, with an operative technic for its correction and a review of nineteen unselected cases.

REDUCTION OF PAIN AND MORBIDITY IN ANORECTAL SURGERY WITH THALAMYD . . . *Louis Segal* 684

A report on 100 patients with various anorectal conditions upon whom surgery was performed. The postoperative pain and morbidity was controlled by the use of thalamyd.

CLOSURE OF ABDOMINAL INCISION WITH CONTINUOUS STEEL SUTURES . *John R. Robinson* 690

The author's thesis is that the closure of abdominal incisions with continuous steel sutures offers excellent results and a minimum of complications. His conclusions are based on 505 operations.

HYPERSENSITIVE CAROTID SINUS REFLEX . . . . *Elmer Hoffman and Samuel Rochberg* 693

A brief description of the carotid sinus reflex, its anatomy, physiology and pharmacology, with the treatment of such a reflex. An illustrative case is reported.

## *Obstetric Clinic*

PELVIC TUMORS. . *Charles A. Gordon, Alexander H. Rosenthal and James L. O'Leary* 696

Presentation of obstetric case histories of maternal deaths due to pelvic tumors, with pertinent questions concerning the management of the cases and the answers to these queries.


*Contents Continued on Page 7*

# Clinical Results* with Banthine® Bromide

(Brand of Methantheline Bromide)

## 22 Published Reports Covering Treatment of 1443 Peptic Ulcer Patients with Banthine

Comprising the reports published in the literature to date which give specific facts and figures of the results of treatment

| AUTHORS | No. of Patients | Chronic, Resistant to Other Therapy | TYPES OF ULCERS | | | | RELIEF OF SYMPTOMS (Chiefly Pain) | | | | Surgery or Compli-cations[1] | Side Effects Requiring Discontinuance of Drug[2] | EVIDENCE OF HEALING | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Duodenal | Jejunal | Stomal | Gastric | Good | Fair | Poor | No Report | | | Complete | Moderate | None | No Report |
| Grimson, Lyons, Reeves | 100 | 100 | 93 | 7 | | | 80 | 11 | 4 | | 5 | | 47 | | 19 | 29 |
| Friedman | 15 | 15 | 14 | | | 1 | 5 | | 4 | 6[3] | | | 2 | | | 13 |
| Bechgaard, Nielsen, Bang, Gruefund, Tobiassen | 26 | 26 | 21 | | | 5 | 16 | 4 | 6 | | | | 8 | 6 | 12 | |
| McHardy, Browne, Edwards, Marek, Ward | 162 | | 162 | | | | 136 | 12 | 11 | | 3 | 1 | 14 | 9 | 7 | 129 |
| Segal, Friedman, Watson | 34 | 34 | 34[4] | | | | 14 | 13 | | | 7 | 2 | 5 | | 8 | 14 |
| Brown, Collins | 117 | 99 | 117 | | | | 97 | 7 | 8 | | 5 | 8 | 55 | 9 | 8 | 40 |
| Asher | 77 | | 65 | | 7 | 5 | 52 | 9 | 16 | | | 16 | | 9 | 21 | 47 |
| Rodriguez de la Vega, Reyes Diaz | 5 | 4 | 5 | | | | 4 | | 1 | | | | | 3 | 2 | |
| Winkelstein | 116 | 116 | 102 | 8 | | 6 | 102 | | 14 | | | | 53 | | 18 | 45 |
| Hall, Hornisher, Weeks | 18 | 18 | 18 | | | | 11 | | 1 | 6[5] | | | 18 | | | |
| Maier, Meili | 38 | 38 | 24 | | | 14[6] | 27 | 7 | 4[7] | | | | 10 | 2 | 5 | 21 |
| Meyer, Jarman | 25 | 18 | 25 | | | | 21 | | 4 | | | | | | | 25 |
| Foth, Fromm | 37 | 37 | 37 | | | | 33 | 3 | 1 | | | | 33 | 3 | 1 | |
| Plummer, Burke, Williams | 41 | 41 | 41 | | | | 36 | | 5 | | | | 38 | | 3 | |
| McDonough, O'Neil | 104 | 100 | 104 | | | | 63 | 10 | 31 | | | 11 | 4 | | 11 | 89 |
| Broders | 60 | 60 | 58 | | 1 | 1 | 35 | 19 | 6 | | | | 10 | 1 | 49[8] | |
| Legerton, Texter, Ruffin | 11 | | 11 | | | | 11 | | | | | | | | | 11 |
| Holoubek, Holoubek, Langford | 76 | 69 | 76 | | | | 35 | 27 | 10 | | 4 | 10 | 26 | | 10 | 36 |
| Ogborn | 42 | | 39 | 2 | | 1 | 42[9] | | | | | | | | | 42 |
| Shaiken | 48 | 48 | 48 | | | | 33 | 10 | 3 | | 2 | | 33 | 10 | 3 | |
| Johnston | 145 | 145 | 145 | | | | 143 | | 2 | | | 2 | 143 | | 2 | |
| Rossett, Knox, Stephenson | 146 | | 141 | | | 5 | 146 | | | | | 4[10] | 53 | | | 93 |
| TOTALS | 1443 | 968 | 1380 | 17 | 8 | 38 | 1142 | 132 | 131 | 12 | 26 | 54 | 552 | 52 | 179 | 634 |
| PERCENTAGES | | 67.8 | 95.6 | 1.2 | 0.6 | 2.6 | 81.3 | 9.4 | 9.3 | | | 3.7 | 70.5 | 6.6 | 22.9 | |

1. Not included in tabulations.
2. Included in "Relief of Symptoms" as "Poor" and in "Evidence of Healing" as "None."
3. Four had no symptoms when Banthine therapy was begun.
4. Of which seven were penetrative lesions and five partially obstructive.
5. No symptoms were present in four.
6. Two with symptoms only; no demonstrable ulcer.
7. Three were psychopathic patients and one had a ventricular ulcer of the lesser curvature.
8. Roentgen findings after treatment period of two weeks; forty-seven had duodenal deformity.
9. All returned to work within a week.
10. In these four, after relief of symptoms, Banthine was discontinued because of urinary retention.

During the past two years, more than 200 references to Banthine therapy in peptic ulcer and other parasympathotonic conditions have appeared in medical literature. Of these reports, 22 have presented specific facts and figures on the results of treatment in a total of 1,443 peptic ulcer patients, 67.8 per cent of whom were reported as chronic or resistant to other therapy. These results are tabulated above and show:

"Good" relief of symptoms was obtained in 81.3 per cent of the 1,405 patients on whom reports were available.

"Complete" evidence of healing was obtained in 70.5 per cent of the 883 patients on whom reports were available.

In all but 9.7 per cent, relief of pain was "good" or "fair." In all but 22.9 per cent, evidence of healing was "complete" or "moderate."

During treatment, 26 patients required surgery or developed complications other than ulcer which required discontinuance of the drug before results could be evaluated.

Of the remaining 1,417 patients, only 3.7 per cent experienced side effects sufficiently annoying to require discontinuance of the drug.

ACCEPTED COUNCIL ON PHARMACY AND CHEMISTRY AMERICAN MEDICAL ASSOCIATION

*Volume containing complete references, with abstracts of 39 additional reports, will be furnished on request by

G. D. SEARLE & Co., P. O. Box 5110, Chicago 80, Illinois.

# The American Journal of Surgery

Reg. U. S. Pat. Off., Nov. 3, 1936

VOL. LXXXIV — Contents • December, 1952 — NUMBER SIX


## Practical Surgical Suggestions


AUREOMYCIN PACKING AS AN ADJUNCT TO THE SURGICAL TREATMENT OF LOCALIZED INFECTIONS . . . . . *Peter J. Marchisello, Aaron Prigot and Louis T. Wright* 708

REPLACEMENT OF THE STOMACH BY THE RIGHT COLON IN TOTAL GASTRECTOMY . . . *J. J. McAleese, F. P. Perrone and G. B. McAleese* 712

A MORE IDEAL APPENDECTOMY INCISION . . . . . *Charles G. Fraser* 717

ATTEMPTED TRANSPLANTATION OF FETAL THYROID IN A CASE OF MYXEDEMA . . . . *Walter J. Burdette* 720


## Case Reports


UTERINE MIXED TUMOR OF NINE YEARS' DURATION . . . . . *V. E. Chesky, W. C. Dreese and C. A. Hellwig* 721

The presentation of a case of uterine mixed tumor with an unusually long time of survival.

CYSTOSARCOMA PHYLLODES (GIANT INTRACANALICULAR MYXOMA) . . *Donald E. Ross* 728

The author briefly reviews the condition, cystosarcoma phyllodes, and presents illustrative case reports.

Primary Intussusception of Appendix with Endometrial Implants . . . . . *Paul C. Morton and Carl S. Oakman* 734

Report of a case of primary intussusception of the appendix, gangrenous appendicitis and endometrial implants within the appendix wall.

FIBROMA OF THE OVARY WITH ABDOMINAL IMPLANTS . . . . . *Russell O. Lyday* 737

An interesting and unusual case is reported, with a satisfactory follow-up of more than three years.

AUTHOR INDEX TO VOLUME LXXXIV . . . . . 739

SUBJECT INDEX TO VOLUME LXXXIV . . . . . 741


*Advertising Index on 3rd Cover*

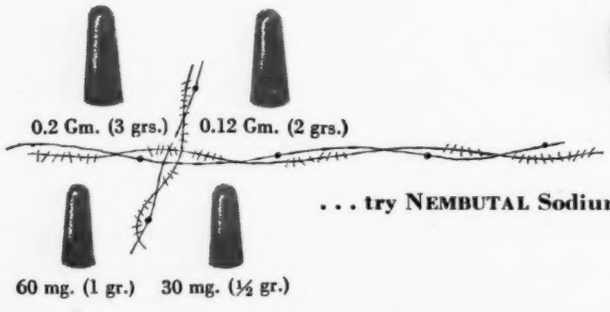
*Change of address must reach us one month preceding month of issue.*

# YOU'D OPEN A PILE OF PRESENTS

***from all the patients who represent the 44 uses for short-acting NEMBUTAL***

. . . at least 44 of them—for 44 uses is the clinical record for short-acting NEMBUTAL. Adjusted doses of short-acting NEMBUTAL can achieve any desired degree of cerebral depression—from mild sedation to deep hypnosis. *And with only about half the dosage of many other barbiturates.* Smaller dosage means less drug to be inactivated, shorter duration of effect, wide margin of safety, and little tendency toward cumulative effect or barbiturate hangover. Remember: In equal oral doses, no other barbiturate combines *quicker, briefer, more profound effect* than NEMBUTAL. Abbott

***For PROMPT SEDATION when the oral route is not feasible . . .***




**Nembutal®**
(Pentobarbital, Abbott)

**. . . try NEMBUTAL Sodium Suppositories**

one lb. was given

one lb. was gained

**To take the guesswork out of energy feeding, Upjohn research has developed Lipomul-Oral—a highly emulsified, well tolerated, well absorbed food-fat. *Given* Lipomul, underweight individuals *gained* an *average* of 1 lb. for each pound of fat ingested as Lipomul . . . *regained* nitrogen balance by the "protein sparing" action of Lipomul.**

# Lipomul*-Oral

***Lipomul-Oral contains:***

| | |
|---|---|
| Vegetable oil | 40% w/v |
| Dextrose, Anhydrous | 10% w/v |
| Preserved with Sodium Benzoate | 0.1% |

***Supplied in pint bottles.***

*Trademark

**Upjohn** *Medicine . . . Produced with care . . . Designed for health*

THE UPJOHN COMPANY, KALAMAZOO, MICHIGAN

# more rapid relief of pain WITH THE **motorized intermittent tractolator***

## WHEN CERVICAL TRACTION IS INDICATED

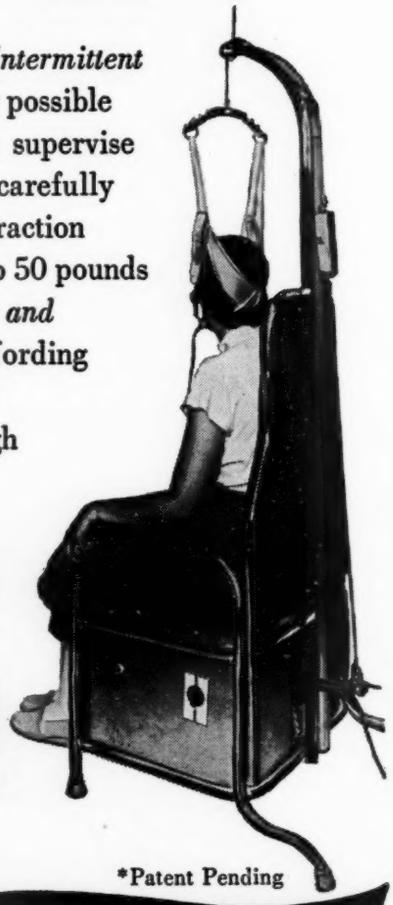
"Some patients who had previously received 5 to 8 pounds of constant traction without relief obtained rapid relief when 25 to 50 pounds of force were applied . . . Constant inadequate traction will not provide relief of pain; whereas adequate traction, even though applied intermittently, will often provide relief."

Intermittent Traction for Herniated Discs—by Bernard Judovich, M.D., Golda R. Nobel, M.D. Medical Times, Jan. 1952; Pain Syndromes—Bernard Judovich, William Bates. F. A. Davis Co., Philadelphia, 4th edition (in press) 1952.

Pain in the Shoulder, Neck, and Arm;
Brachial Plexus pain due to:

- **Herniated Cervical Disc**
- **Osteoarthritis of the Cervical Spine**
- **Narrowed Intervertebral Foramen**
- **Other Conditions in Which Cervical Traction is Indicated**

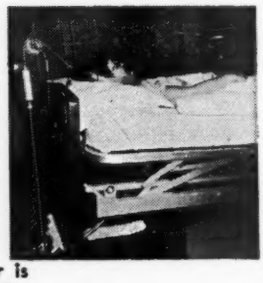
With the *Motorized Intermittent Tractolator*, it is now possible for the physician to supervise administration of a carefully graduated, smooth traction force with pulls up to 50 pounds . . . *safely, precisely and automatically* . . . affording relief of pain often unobtainable through other techniques.



## Suitable for Hospital or Office Therapy

- *Comfortable*
- *Sturdy*
- *Automatic*

The *Motorized Intermittent Tractolator* is now in daily use in physicians' offices and hospitals. It is a dignified, handsome addition to your professional equipment, designed in consultation with the medical profession. Duration and amount of pull are automatic, once set for treatment. The apparatus is easily adjusted to the individual patient. Complete, simple instructions are provided with each Tractolator.



**The *Motorized Intermittent Tractolator* is also available as a bed apparatus for cervical and lumbar traction. Details on request.**

*Patent Pending

WRITE FOR INFORMATION, CASE HISTORIES, LITERATURE

Louis Yellin, Inc.
Surgical & Orthopaedic Appliances

251 South 17th Street
(Medical Tower Building)
Philadelphia 34, Pa.

# A GUIDE FOR NATURE'S REPAIR OF FRACTURED BONES

EGGERS TYPE

# VITALLIUM INTERNAL CONTACT SPLINT

**Encourages earlier bony union . . . assures optimum placement of screws . . . provides fully adequate fracture support.**

Vitallium Internal Contact Splints are slotted bone plates—permitting fractured bone ends to move together and to be in constant contact under muscular pressure when concurrent necrosis, absorption and osteogenesis of the traumatized bone ends occur. They keep the fractured bone in longitudinal alignment and provide lateral stability. Fragments are locked securely, and rotation is hindered by the combination of longitudinal muscular pull and screw fixation.

The Eggers splints thus serve as guides for nature's repair of fractured bones. Under the influence of splinting, compression, and contact, mechanical and physiological conditions favorable to early bone union are created.

The slots in the plates facilitate placing the screws in the most desirable locations—as far from the fracture site as possible. Loose bone fragments may be engaged firmly with additional screws.

ORDER THROUGH YOUR SURGICAL DEALER

Available in lengths of 3″, 4″, 5″ and 6″ with Eggers type screws.

**References:** "Internal Contact Splint" —Eggers, G.W.N.
Jour. Bone & Joint Surg., 30-A, No. 1, Jan. 1948
"The Influence of The Contact-Compression Factor on Osteogenesis in Surgical Fractures" — Eggers, G.W.N., Shindler, T.O. and Pomerat, C.M.,
Jour. Bone & Joint Surg., 31-A, No. 4, Oct. 1949

AUSTENAL SURGICAL DIVISION
LABORATORIES, INC.
224 EAST 39th STREET • NEW YORK 16, N. Y.

# BARD ◇ U.S.C.I. Woven Catheters

The Smaller Sizes
are COLOR-BANDED
for Easy Selection
Reg. U. S. Pat. Off. 535061

*"The Accepted Standard of Excellence"*

**BARD ◇ U.S.C.I. WOVEN CATHETERS**

are precision engineered of fine materials for dependable service. They possess the proper degree of flexibility for facile introduction. The eyes and lumen are uniformly of the correct size for adequate drainage. They are sterilizable by boiling or autoclaving. For cold sterilization we recommend Detergicide.

***See Your Surgical Supply Dealer***

*When a human life may be at stake there can be no Compromise with* ***Quality***

BARD UROLOGICAL INSTRUMENTS

C. R. BARD, Inc., Summit, N. J.
*Distributors for*
UNITED STATES CATHETER and INSTRUMENT CORP.

*THERE IS NO SATISFACTORY SUBSTITUTE FOR QUALITY*

Mallinckrodt®

Announces

# UROKON® SODIUM 70%

(IN ADDITION TO UROKON SODIUM 30%)

a Safe, Satisfactory, Concentrated diagnostic medium for...

INTRAVENOUS UROGRAPHY

NEPHROGRAPHY

TRANSLUMBAR ARTERIOGRAPHY

ANGIOCARDIOGRAPHY

Urokon Sodium Brand of Sodium Acetrizoate

CAUTION: Federal law prohibits dispensing without prescription.
Mallinckrodt®
Each cc. contains 0.7 Gm UROKON SODIUM, 0.12 mg. calcium ethylene diaminetetraacetate as a stabilizer, and 0.12 mg sodium biphosphate as a buffer.
1153
STERILE SOLUTION
UROKON® SODIUM
70%
BRAND OF SODIUM ACETRIZOATE
FOR INTRAVASCULAR RADIOGRAPHY
STERILE SOLUTION
UROKON® SODIUM 70%
MALLINCKRODT CHEMICAL WORKS
ST. LOUIS • NEW YORK

UROKON® SODIUM 70%

*AVAILABLE NOW*

**MALLINCKRODT CHEMICAL WORKS**

ST. LOUIS – NEW YORK

CHICAGO • CINCINNATI • CLEVELAND • LOS ANGELES • PHILADELPHIA
SAN FRANCISCO • MONTREAL • TORONTO

MALLINCKRODT CHEMICAL WORKS

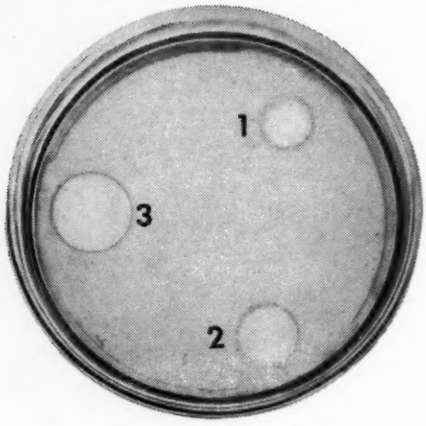
Second & Mallinckrodt Sts., St. Louis 7, Mo.
or
72 Gold Street, New York 8, N. Y.

**Please send me information on**
**STERILE SOLUTION UROKON® SODIUM 70%**

Name _____ M.D.

Address _____

City _____ Zone _____ State _____




Inhibitory action of penicillin (*1*), streptomycin (*2*), and PENSTREP (*3*), on a mixed culture of gram-positive and gram-negative organisms.

# For Wide-Spectrum Bactericidal Action

PENSTREP **"4:½"** | PENSTREP **"4:1"**

PENSTREP supplies a total of 400,000 units of Crystalline *Penicillin* together with Crystalline *Dihydrostreptomycin Sulfate*—the purest form of dihydrostreptomycin available. PENSTREP provides potent, synergistic bacteri*cidal* action that is effective over a *wide-range* spectrum.

PENSTREP "4:½" contains ½ Gm. of dihydrostreptomycin; PENSTREP "4:1" contains 1 Gm. It is recommended that "4:1" be used for short, intensive periods of therapy, "4:½" for prolonged treatment periods.

*Supplied:* PENSTREP "4:½": dry mixture for aqueous injection; also, aqueous suspension, ready to inject.

PENSTREP "4:1": dry mixture for aqueous injection.

All product forms available in one- and five-dose vials.

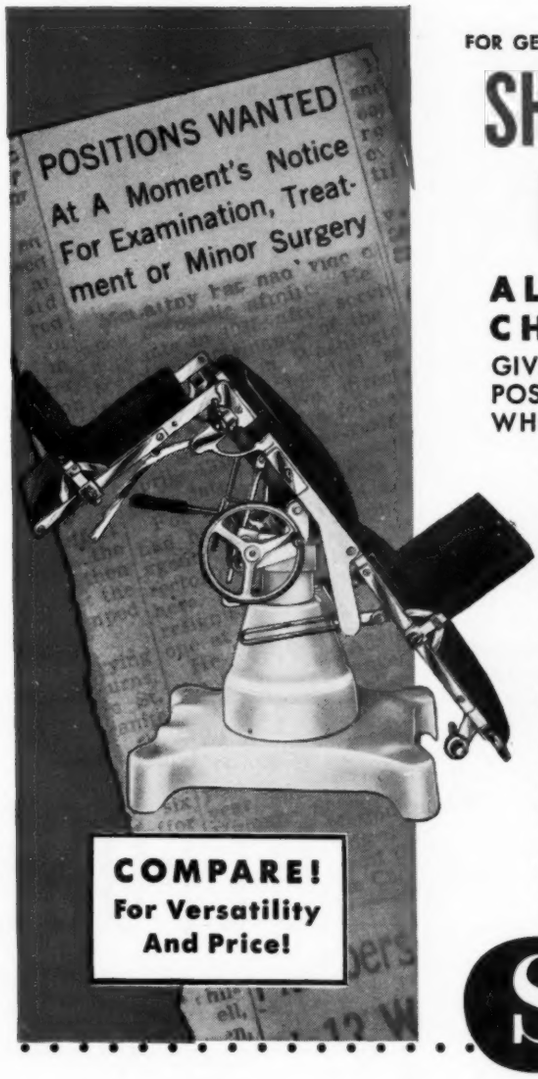
# PenStrep*

*PENSTREP is a trade-mark of Merck & Co., Inc.

*Research and Production for the Nation's Health*

MERCK & CO., INC.
*Manufacturing Chemists*
RAHWAY, NEW JERSEY
In Canada: MERCK & CO. Limited—Montreal

© Merck & Co., Inc.




FOR GENERAL OR SPECIAL PRACTICE

# SHAMPAINE MARTIN

## ALL-PURPOSE CHAIR TABLE

GIVES YOU THE *EXACT* POSITION YOU WANT— WHEN YOU WANT IT!

Fulfills every one of your requirements for examination, treatment and minor surgical work.

**Accurate Position**—Whether it's E.E.N.T., GYN, Protoscopic, GU or general work the Martin table provides the correct position.

**Easy Adjustment**—Height, Trendelenberg positions, rotation of the top are all made by simply operated controls.

**Patient Comfort**—The patient can relax completely on the Martin table's comfortable padding and durable upholstery.

Shampaine COMPANY

PLEASE SEND ME COMPLETE INFORMATION ON THE MARTIN ALL-PURPOSE CHAIR TABLE
SHAMPAINE CO., DEPT. P-12
1920 SO. JEFFERSON AVE.
ST. LOUIS 4, MISSOURI

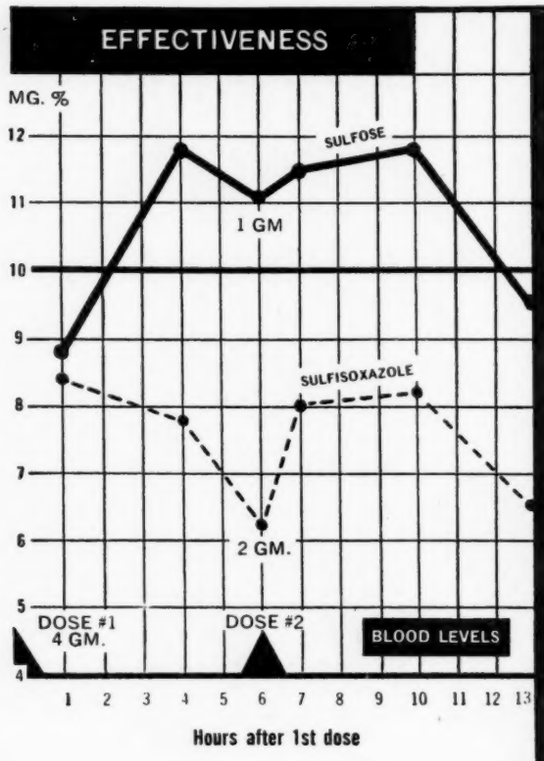
My dealer is_____

Dr._____

Address_____

City_____ Zone____ State_____

## why SULFOSE for sulfonamide therapy




- Higher, better sustained blood levels
- Superior tissue distribution
- Additive action against sulfonamide-sensitive organisms
- Fewer daily doses

SUSPENSION

# SULFOSE®

TRIPLE SULFONAMIDES
WYETH

SUPPLIED: Bottles of 1 pint. Each teaspoonful (5 cc.) supplies 0.5 Gm. total sulfonamides (0.167 Gm. each of Sulfadiazine, Sulfamerazine and Sulfamethazine) in a special alumina gel suspension

Also available: Tablets SULFOSE, 0.5 Gm.; bottles of 100

Wyeth®

# *Uniform Absorption*

## ETHICON® *catgut*




**ETHICON Tru-Chromicized Catgut varies less than 10% in absorption time — *regardless of size*. Ordinary surface-chromicized gut varies up to 400%.**

The exclusive ETHICON Tru-Chromicizing Process assures the same absorption rate for *all* sizes of Surgical Gut. This unique feature becomes increasingly important to the surgeon as suture size diminishes, for one of the main purposes of fine gut is to minimize tissue reactions.

Because of its relatively larger surface area, fine gut contains more chrome *when processed by the common surface-chromicizing method*—hence may require three to five times longer to be absorbed than larger sizes. Foreign body reactions to such gut are apt to be protracted, with poorer healing, draining sinuses and knot extrusion.

ETHICON Tru-Chromicized Gut eliminates these hazards, since its chrome is evenly distributed *throughout* the cross-section of the strand. Small sizes of ETHICON Surgical Gut may be used with the assurance that they will be absorbed at the proper time, and that repair can proceed without interference.

## TEMPER-TESTED
## FOR OPTIMAL STRENGTH AND FLEXIBILITY

# ATRALOC® *Needle Sutures*

The Ethicon® electrical tempering method assures *uniform* needle strength; the result is a smaller diameter, yet stronger needle with optimal flexibility and maximum stiffness. For the surgeon, ATRALOC provides outstanding advantages:

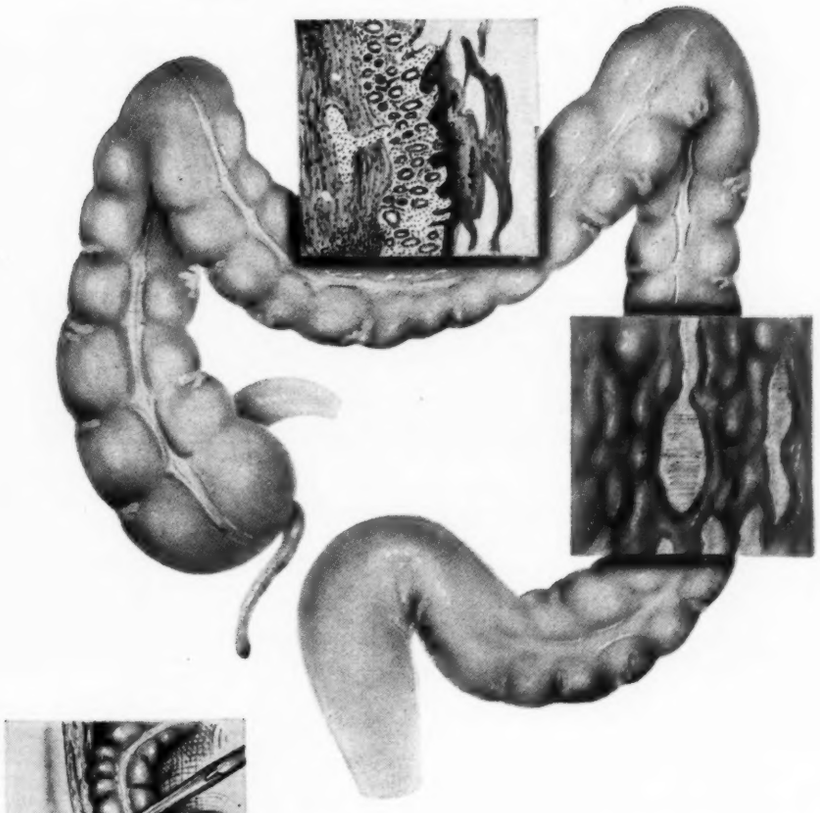
- minimal tissue trauma — needle carries single strand
- saves time of needle threading
- eliminates unthreading during operation
- improved points and constant sharpness
- longer, more useful flat area — needle won't turn in holder

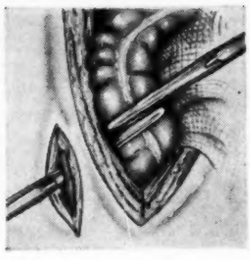
**ATRALOC Seamless Needles are needles of choice for general closure, obstetrics, gynecology and most procedures where catgut is indicated.**

**ETHICON**
SUTURE LABORATORIES
INCORPORATED

SUTURE LABORATORIES AT NEW BRUNSWICK, N. J.; CHICAGO, ILL.; SAO PAULO, BRAZIL; SYDNEY, AUSTRALIA; EDINBURGH, SCOTLAND.

*to rid the intestine*
*of pathogens*





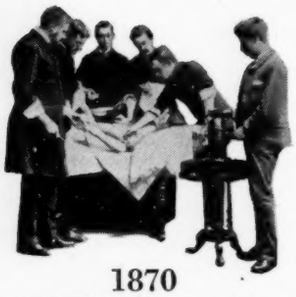
# THALAMYD

has only one function—to rid the intestine of sulfonamide-sensitive bacteria in bacillary dysentery and ulcerative colitis, and when preparing the patient for elective intestinal surgery. THALAMYD,® phthalylsulfacetamide-Schering not only eliminates susceptible enteric organisms *in the lumen of the gut, but also penetrates into the bowel wall by diffusion* to combat embedded bacteria. Being virtually nonabsorbable, it does not enter the blood stream—carries little risk of sensitization or adverse effect on hematopoietic or renal systems.

Schering CORPORATION • BLOOMFIELD, N. J.

THALAMYD

SCHERING

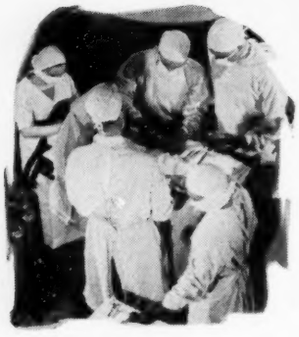


1870

"Antiseptic" surgery during the reign of the carbolic spray. From a rare old photograph. Courtesy of The Bettmann Archive.

**THE FIRST** year of Gudebrod's long history of specialization in the manufacturing of fine silk for sutures was way back in 1870. Gudebrod's sewing silk was widely used for suturing until the turn of the century when the first silk sutures, labeled "Surgeon's Silk," were introduced by Gudebrod.

**Specialization for 82 years produces the finest sutures**



1952

The transition from the "antiseptic surgery" of 1870 to the aseptic technics of 1952 is just one of the many forward strides of modern surgery.

**THE FOREMOST** manufacturer of non-absorbable sutures, Gudebrod has pioneered in the development of modern suture materials, contributing largely to the dependable excellence of present-day silk, cotton and nylon sutures.

Gudebrod is foremost with

***Champion Serum-Proof Silk***

**Stronger, smoother, more uniform**

**Greater ease of handling**

**Maximum resistance to serum penetration**

**50% better after autoclaving**

Gudebrod BROS. SILK CO., INC.

225 West 34th Street, New York 1, N. Y.

PHILADELPHIA • CHICAGO • LOS ANGELES • BOSTON • DALLAS

*first and foremost name in non-absorbable sutures*

# clinically confirmed...

# Efocaine*

## long-acting local anesthetic-analgesic

for prolonged, non-narcotic control of pain

**64 cases** — **in surgery of the head, neck and extremities**[1,2]
Postoperatively 35 patients required no narcotics, another 24 required only 1 or 2 doses; no patient required more than 4 doses.

**187 cases** — **in thoracic and upper abdominal surgery and chest pain**[1,2,3,4]
Postoperative intercostal nerve block with Efocaine allowed patients to breathe deeply and cough freely without pain, obviated the need for respiration-depressing narcotics—"an effective means of preventing postoperative pulmonary complications."[4] "... more than 50 blocks for miscellaneous chest pain ... were all successful."[4]

**346 cases** — **in lower abdominal surgery**[1,2]
Convalescence was pleasanter and early ambulation was facilitated with Efocaine. In one group of 285 patients, 87 required no postoperative narcotics, and 141 needed only 1 or 2 doses.[2]

**246 cases** — **in anorectal and vaginal surgery, pruritus ani**[1,2,5,6]
"A dramatic relief of postoperative pain ... in almost every instance ... postoperative narcotic requirements were virtually eliminated."[5]
"All of the patients with pruritus ani were benefited by ... Efocaine."[6]

**45 cases** — **following tonsillectomy**[7]
"The results ... were most dramatic. A high degree of local pain control was achieved in every instance."

**94 cases** — **after episiotomy**[8]
"A high degree of episiotomy pain-relief was obtained ... patient morbidity was greatly reduced, and a more pleasant convalescence achieved."

**25 cases** — **in minor and office surgery**[1]
Relief of postoperative pain was excellent in 76% of the group, good in the remaining 24%.

Clinical experience with EFOCAINE in over 1,000 patients is now recorded in the medical literature. This experience, summarized above, demonstrates unequivocally that EFOCAINE achieves at last a long-sought goal in medicine and surgery: *prolonged, non-narcotic pain control.*

a single injection

- produces 6-12 days local anesthesia-analgesia
- provides dramatic, long-lasting relief of pain
- virtually eliminates postoperative narcotics

**safe**
**nonoily**
**aqueous-miscible**
**no vasoconstrictors**

1. Ansbro, F. P., and others: Anesthesiology *13*:306, 1952. 2. Iason, A. H., and Shaftel, H. E.: Postoperative Pain Control, presented before the Section on Anesthesiology of the American Medical Association, Chicago, Ill., June 10, 1952. 3. Deaton, W. R., Jr., and Bradshaw, H. H.: Am. Surgeon *18*:616, 1952. 4. Puderbach, W. J., and others: Journal Lancet *72*:203, 1952. 5. Tucker, C. C.: J. Kansas M. Soc. *53*:230, 1952. 6. Gross, J. M., and others: New York State J. Med. *52*:1413 (June 1) 1952. 7 Penn, S. E.: Arch. Otolaryng. *56*:59, 1952. 8. Cappe, B. E., and Pallin, I. M.: Am Pract & Digest Treat. *3*:739, 1952.

EFOCAINE, a depot solution, is supplied in 20-cc. multiple-dose vials.

Detailed literature available upon request.

FOUGERA

**E. FOUGERA & CO., INC.**

*T.M.

**75 Varick Street, New York 13, N. Y.**

*For The Urologist—*
*The Utmost In Electrosurgical Utility!*

# WAPPLER
## SURGICAL UNIT
## C-263

Designed primarily to meet the exacting requirements of urologic electro-surgery, this WAPPLER SURGICAL UNIT combines great power with precise and **blended** control (when required) of cutting and coagulating currents in any proportion desired. For transurethral resections, and other urologic procedures, this high frequency unit cuts and coagulates with such ease and speed as to expedite materially the most difficult techniques. When the employment of tissue cutting and haemostatic currents is indicated in other fields, such as General, Thoracic, Proctologic, Ophthalmologic Surgery, etc., the remarkable simplicity of control, complete dependability and uniformly excellent results achieved with the WAPPLER C-263 recommend it as the instrument of choice.

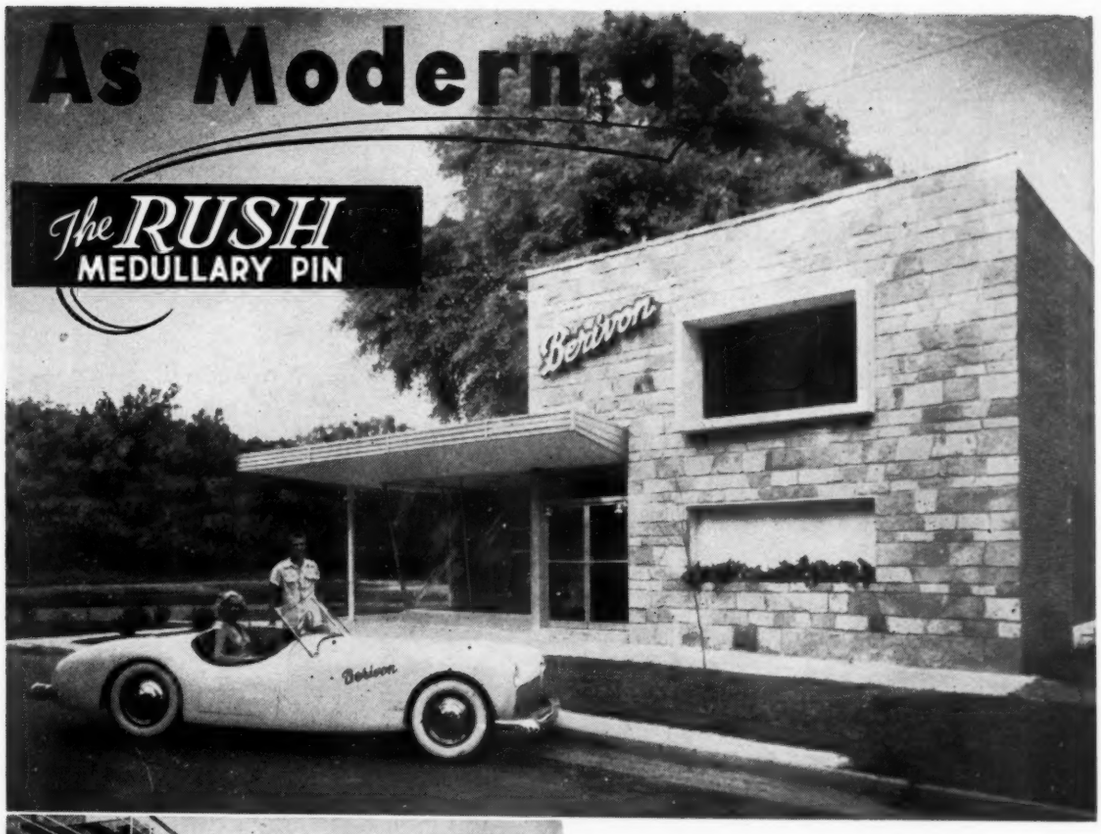
**Splashproof Footswitch permits ready current selection and control by operator, once rheostats are set.**

*See Your Dealer—*
*Write for Literature*

A·C·M·I· TRADE MARK

AMERICAN CYSTOSCOPE MAKERS, INC.

1241 LAFAYETTE AVE. FREDERICK J. WALLACE, President NEW YORK 59, N. Y.



THE BUILDING - - - - - - -
The better to serve you with.

THE SPEEDSTER - - - - - - -
The faster to serve you with.

THE BOY AND GIRL - - - - - - -
Beryl and Vaughan Rush, from whose names the word BERIVON® was derived.

BERIVON® on your pin means:

1. Optimum temper, based on 15 years clinical research.
2. Minimal tissue irritation.

All Rush pins are hand fashioned of type 316 stainless steel. They are cold worked and electro-polished to remove foreign debris.

The Berivon Company was established for the expressed purposes of safeguarding the quality of the Rush Medullary Pin and for surgical engineering research.

*Manufactured Exclusively by:*

THE BERIVON Company

MERIDIAN, MISS.

# *ONE KILLS FASTER*

**Antiseptics that stab at bacterial invasions ...killing some but not all organisms... lack decisive germicidal action.**

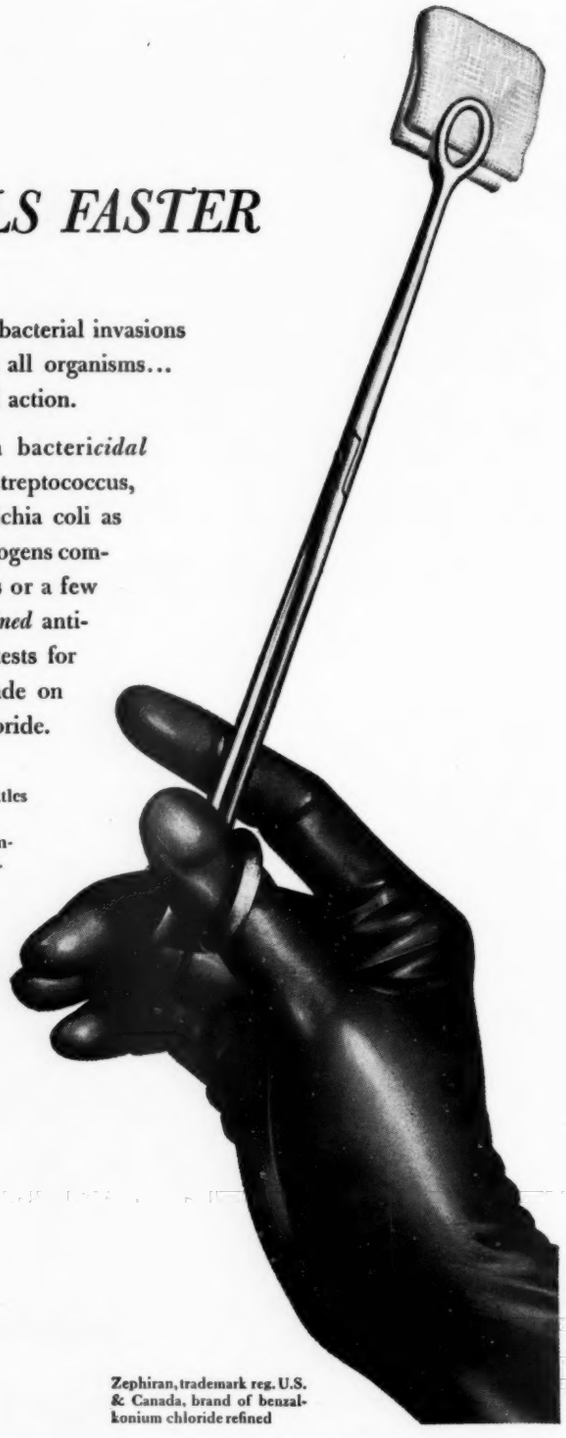
**Zephiran chloride—a bacteri*cidal* agent—kills hemolytic streptococcus, staphylococcus, Escherichia coli as well as many other pathogens completely within seconds or a few minutes in vitro. A *refined* antiseptic, pharmacologic tests for tissue tolerance are made on each lot of Zephiran chloride.**

**Supplied as:**

**Aqueous Solution 1:1000, bottles of 8 oz. and 1 U. S. gallon.**

**Tincture 1:1000, tinted and stainless, bottles of 8 oz. and 1 U. S. gallon.**

**Concentrated Aqueous Solution 12.8%, bottles of 4 oz. and 1 U. S. gallon (1 oz.=1 U. S. gallon 1:1000 solution). Must be diluted.**



# *ZEPHIRAN*®

CHLORIDE

*for antisepsis with finesse...*

*Winthrop-Stearns* Inc.

New York 18, N. Y. • Windsor, Ont.

**Zephiran, trademark reg. U.S. & Canada, brand of benzalkonium chloride refined**

# THE *Automatic Wound Clip Applier*

## EQUAL TO YOUR SKILL AND SPEED

PATENT APPLIED FOR

*Saves Time—Automatically Feeds Wound Clips to the Applying Forceps—No Assistant Is Necessary . . .*

*Saves Clips—Fewer Double Autoclips Are Needed . . . Compact, Light Weight—Always Ready for Use*

*Skin Closure (above) is quick and easy, with better cosmetic effect*

*Skin Towel (right) being attached to edges of an incision with Autoclips . . . Also excellent as scalp clips*

**AUTOCLIPS**
**Are Double Wound Clips**
**Fewer Are Needed**
**ARE EFFICIENT**
**As Towel Clips**
**As Scalp Clips**
**Have Greatest Holding Quality with Absolute Minimum Trauma**

For both emergency and general use—and especially where assistance is not at hand—the new Totco Autoclip Applier gives you an effective, speedy technique of skin closure that promotes faster healing, better cosmetic results and minimum trauma. The Applier holds 20 Autoclips, delivers them one by one as fast as the wound edges can be approximated, permitting your concentration on the actual closure alone.

*Autoclips are double clips, so fewer are needed. They hold more firmly than ordinary wound clips, and skin approximations are more readily controlled. They won't catch in gauze dressings. In addition, they are easily, painlessly removed—may even be adjusted after they've been placed.*

The handy Autoclip Applier weighs only two ounces. It can be kept loaded and sterile for use at any time—is ideal for your bag. Reloading takes but a second, and partial racks of Autoclips can be combined for both convenience and economy.

*Autoclip Applier, rustless metal, chrome plated. Each, $23.50.*

*Autoclips, double wound clips, 18 mm. size, nickel silver. 20 clips to rack; 5 racks to box. Per 100 clips, $2.40. Per 1000 clips, $22.00. (5% discount in 5000s; 10% in 10000s.)*

*Autoclip Remover. Painlessly removes Autoclips at the angle of insertion. Also adjusts clips after placement. Each, $6.00.*

*Complete Literature Will Be Sent Promptly on Request*

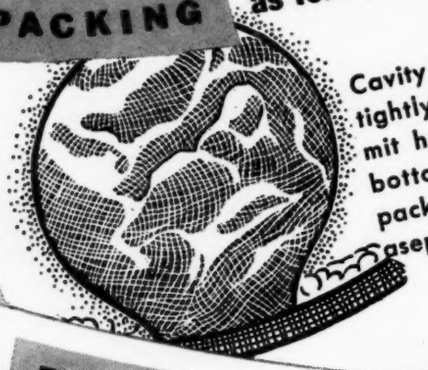
*Order Direct from*

**V. Mueller & Co.**

**Instrument Makers To The Profession Since 1895**

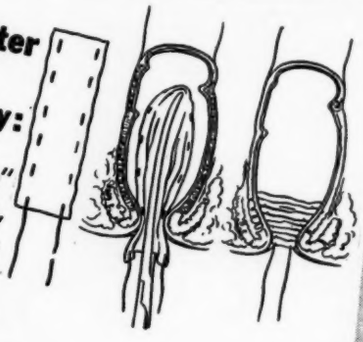
**330 SOUTH HONORE STREET** **CHICAGO 12, ILLINOIS**

**PACKING** as for abscess cavity:



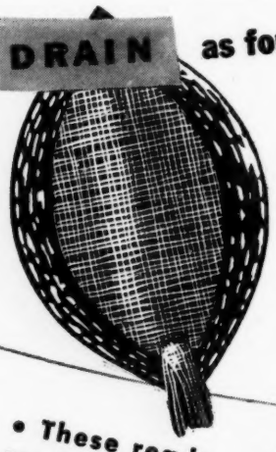
Cavity is fully but not tightly packed to permit healing from the bottom — and is repacked weekly, using aseptic precautions.

**PLUG** as after **hemorrhoidectomy:**



Petrolatum gauze "sponge" is (a) threaded as shown, (b) inserted beyond sphincter, (c) and then pulled down snugly against bleeding points.

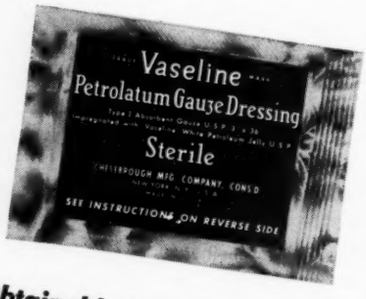
**DRAIN** as for septic wounds:



Non-toxic, non-adherent, non-macerating—will not cause pressure necrosis or erosion...increasingly used in place of rubber drainage tubes.

• **These ready-made dressings now available in three sizes:**

No. 1: 3" x 36" (6 in carton)
No. 2: 3" x 18" (12 in carton)
No. 3: 6" x 36" (6 in carton)




***Obtainable from your regular source of supply***

# Specified for "1001" SURGICAL USES

## Vaseline
TRADE-MARK ®

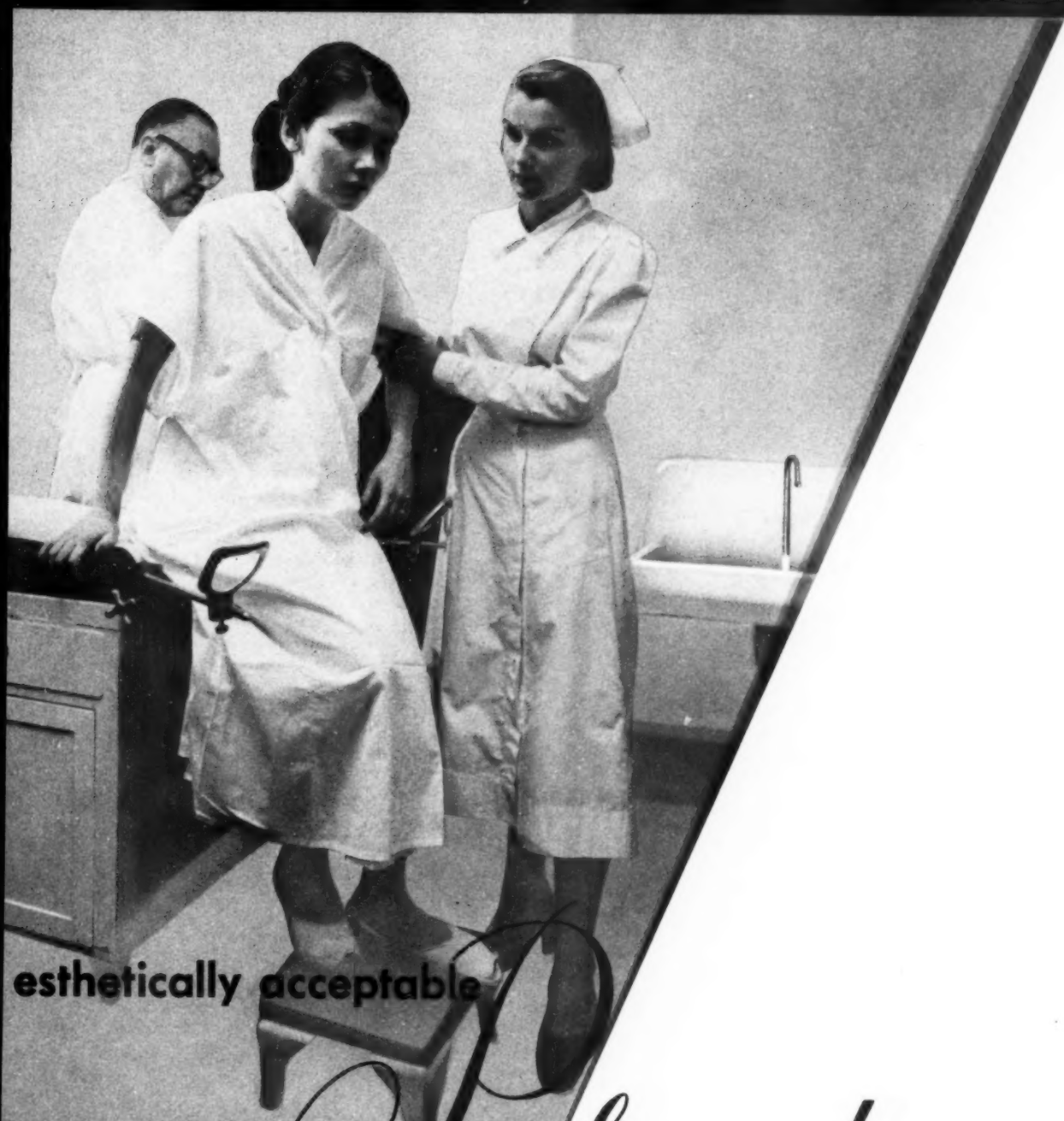
## Sterile Petrolatum Gauze Dressings

**Adopted as standard procedure by surgeons, as preferred matériel by ORS's and CSS's, these superior dressings are used as wound coverings and packings, as plugs and drains—as well as being the most widely-used definitive dressing for burns and abrasions.**

**CHESEBROUGH MFG. CO., Cons'd**
**Professional Products Division**
**NEW YORK 4, N. Y.**

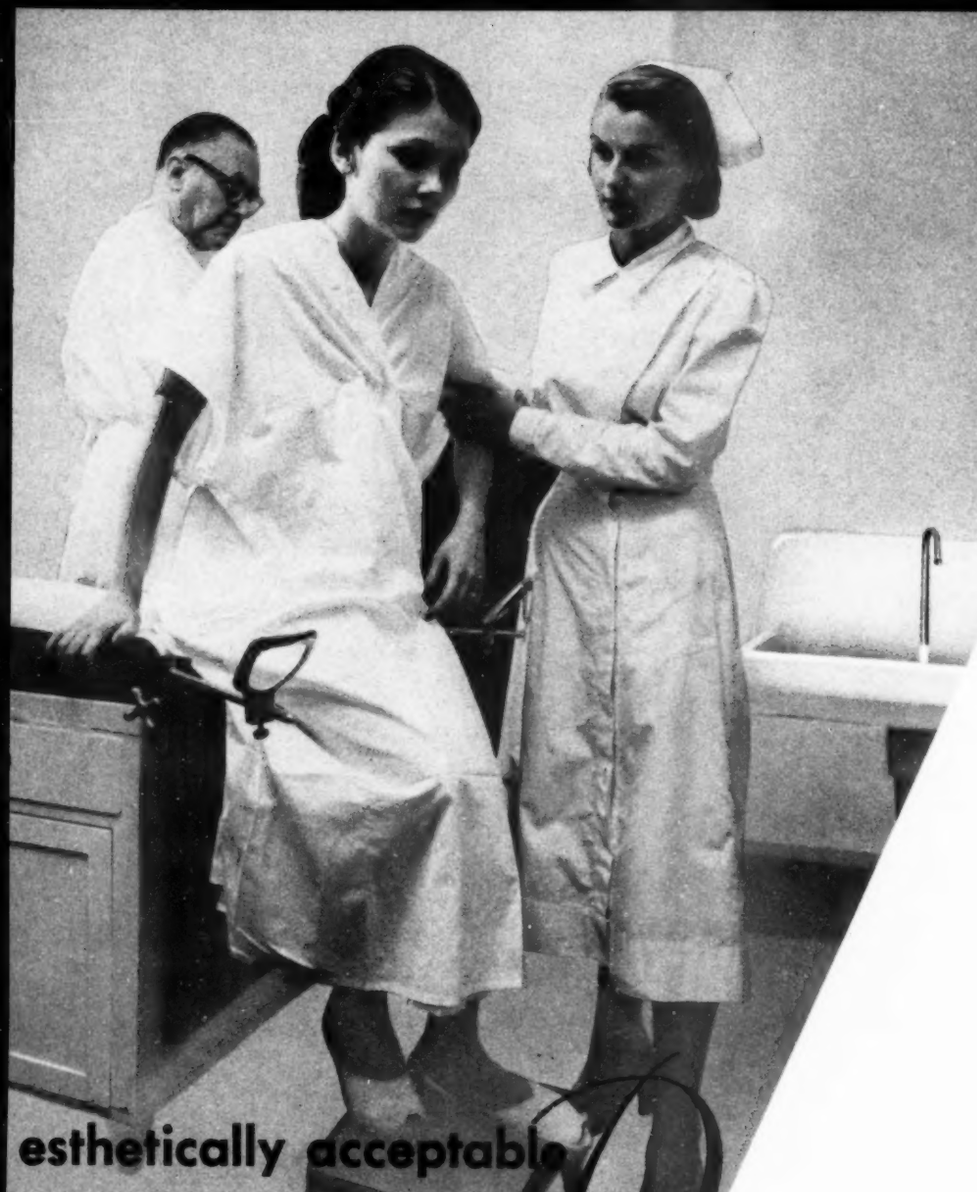
***Insist on these superior ready-made, dependably sterile dressings—for your use in indicated surgery, major or minor, emergency or elective.***

**VASELINE is the registered trade-mark of the Chesebrough Mfg. Co., Cons'd**



esthetically acceptable

*Preferred* by patients
for simple,
dependable
conception control



esthetically acceptable

Preceptin®

VAGINAL GEL

with measured-dose applicator

requires no diaphrag

**PRECEPTIN vaginal g**
contraception and be
It is free from many of

**PRECEPTIN vaginal g**
does not "le
does not inte
does not hav
in most
has no notice
is a smooth v

**PRECEPTIN vaginal g**
Proved Effec

**the barrier is bu**

gel was specifically designed to simplify
acceptable to women and their husbands.
the unesthetic features of other methods.

gel
eak"
erfere with normal coitus
ve the excessive lubricating properties inherent
t vaginal jellies
eable odor
white GEL . . . not a jelly or cream

gel
ctive • Proved Well Tolerated • Proved Easier To Use

**ilt into the Gel base**

**gm**

Ortho

## applicator method:

### administration of PRECEPTIN vaginal gel

Insertion of PRECEPTIN vaginal gel should be made just prior to coitus. Completely fill the measured-dose (5 cc.) applicator. Insert gently, well into the vaginal canal. Depress plunger and, with plunger still depressed, remove applicator.

An additional application of the Gel should be made prior to each subsequent coitus.

A douche is not necessary following the use of PRECEPTIN vaginal gel. However, if a douche is desired, a lapse of at least six to eight hours following intercourse should be recommended prior to douching.

### composition

PRECEPTIN vaginal gel contains the active spermicidal agents p-Diisobutylphenoxypolyethoxyethanol and ricinoleic acid in a synthetic base buffered at pH 4.5.

### packaging

3-ounce tube *with applicator* • 3-ounce *tube only* (refill)

*On initial prescriptions please specify "PRECEPTIN vaginal gel with applicator."*

Ortho

## diaphragm method:

**when indicated . . . a diaphragm with**

**the most widely prescribed vaginal jelly and cream**

**in attractive, flexible "Lumite" woven plastic zipper kits**

### Ortho® White Kit

Ortho-Gynol® vaginal jelly (regular size tube)

Ortho® Creme vaginal cream (trial size tube)

Ortho®-White Diaphragm (flat spring) 55 mm. to 95 mm.

ORTHO-GYNOL® vaginal jelly — ricinoleic acid 0.75%, boric acid 3.0%, oxyquinoline sulphate 0.025%, p-Diisobutylphenoxypolyethoxyethanol 1.00%.

### Ortho Kit®

Ortho-Gynol vaginal jelly (regular size tube)

Ortho Creme vaginal cream (trial size tube)

Ortho® Diaphragm (coil spring) } 55 mm. to 95 mm.

Ortho® Diaphragm Introducer }

ORTHO® CREME vaginal cream — ricinoleic acid 0.75%, boric acid 2.0%, sodium lauryl sulphate 0.28%.

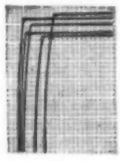
*yours for the asking*

**"Modern Methods of Conception Control"**—This illustrated chart has proved invaluable as an aid in instructing patients in the proper use of the **diaphragm-and-jelly method** and the **applicator method** of contraception. Ask your Ortho Representative for a copy or write to the Professional Service Department.

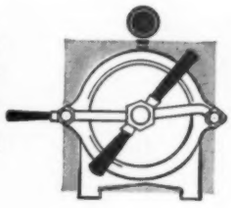
**Ortho Pharmaceutical Corporation**
**Raritan, New Jersey**

# *New improved* ANACAP®
## SURGICAL SILK

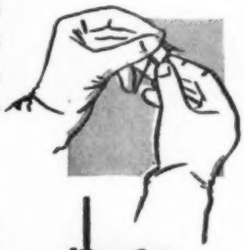
**5** *ways better than ever before —*



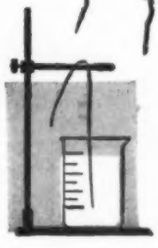
**1** *Greater tensile strength.* **One of the strongest silks ever created — smaller diameter sizes can be used everywhere to minimize trauma and foreign body reaction.**



**2** *Withstands repeated sterilization:* **New Anacap Silk can be boiled or autoclaved *six separate times* without appreciable change in either strength or texture. In laboratory tests almost the full original strength is maintained even after 23½ hours of boiling.**



**3** *Easier to handle:* **Firmer, not limp, Anacap Silk speeds operative technic. Braided by a new method that minimizes "splintering" and "whiskering" it passes readily through tissues. The ease of handling Anacap makes it a "new experience" in silk suturing.**



**4** *Absolute non-capillarity:* **Having no wick-like action, new Anacap Silk is resistant to body fluids and will not spread an early localized infection if it occurs.**

**5** *Doubly economical:* **Low in original purchase price, new Anacap Silk is also low in individual suture cost because of its long sterilization life.**

***In sizes 6-0 to 5 on spools of 25 and 100 yards; sterile in tubes with and without D & G Atraumatic® needles attached.***

## DAVIS & GECK, INC.

*57 Willoughby Street* D&G® *Brooklyn. 1, N. Y.*

# CHEMICAL DISINFECTION PROBLEMS DISAPPEAR

when you use **BARD-PARKER**

**FORMALDEHYDE GERMICIDE**

containing HEXACHLOROPHENE (G-11*)

For practical purposes we suggest the selection of B-P CONTAINERS—all especially designed for use with the solution.

B-P Germicide has established a new standard of efficiency and economy for solutions used in the chemical disinfection of surgical instruments. It will destroy vegetative pathogens and spore formers within 5 minutes, and the spores themselves within 3 hours. See comparative chart.

Prolonged immersion of delicate steel instruments in B-P Germicide will not result in rust or corrosive damage to surfaces or keen cutting edges. The solution will retain its high potency over long periods if kept undiluted and free of foreign matter.

** Trademark of Sindar Corp.*

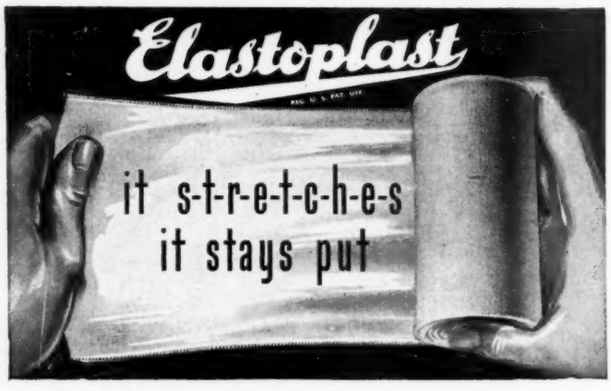
*Ask your dealer*

**PARKER, WHITE & HEYL, INC.**
**Danbury, Connecticut**

**Kills tubercle bacilli within 5 minutes**

*Compare this significant data evaluating the potency of the IMPROVED germicide*

| SPORULATING BACTERIA | 50% DRIED BLOOD | WITHOUT BLOOD |
|---|---|---|
| Cl. tetani | 3 hours | 3 hours |
| Cl. welchii | 2 hours | 2 hours |
| B. anthracis | 1½ hours | 1½ hours |
| VEGETATIVE BACTERIA | | |
| Staph. aureus | 5 min. | 15 sec. |
| E. coli | 3 min. | 15 sec. |
| Strept. hemolyticus | 2 min. | 15 sec. |




*For Comfort . . .*
*Neatness . .*
*For Support . . .*
*Compression*

**The Dependable Original E-L-A-S-T-I-C Adhesive Bandage**

# ELASTOPLAST

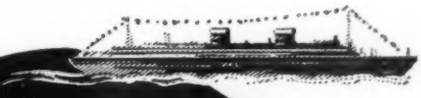
**Trade Mark**

Molds and holds to any contour . . . Allows joint motion . . . Provides firm support and controllable compression . . . Does not slip. Assures the neatest, most comfortable dressing in private and hospital practice. Available at your dealer in widths of 1, 2, 2½, 3, 4, 5 and 6 inches, 3 yards long (slack).

*** Elastoplast is also available in convenient unit dressings and compresses. Write for literature.**

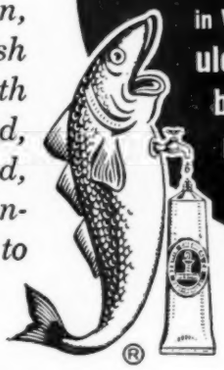
**DUKE LABORATORIES, INC.**
STAMFORD, CONN.

# FULL SPEED AHEAD in TISSUE REPAIR



**DESITIN®**
**OINTMENT**
the pioneer external cod liver oil therapy

in **wounds** (especially slow healing)
**ulcers** (decubitus, varicose, diabetic)
**burns, perianal dermatitis**
**non-specific dermatoses**



DESITIN Ointment *proves in everyday practice its ability to ease pain, renew vitality of sluggish cells, and stimulate smooth tissue repair in lacerated, denuded, chafed, irritated, ulcerated tissues—in conditions often resistant to other therapy.*[1-3]

Protective, soothing, healing, Desitin Ointment is a non-irritating blend of high grade, crude Norwegian cod liver oil (with its unsaturated fatty acids and high potency vitamins A and D in proper ratio for maximum efficacy), zinc oxide, talcum, petrolatum, and lanolin. Desitin Ointment does not liquefy at body temperature and is not decomposed or washed away by secretions, exudate, urine or excrements. Dressings easily applied and painlessly removed.

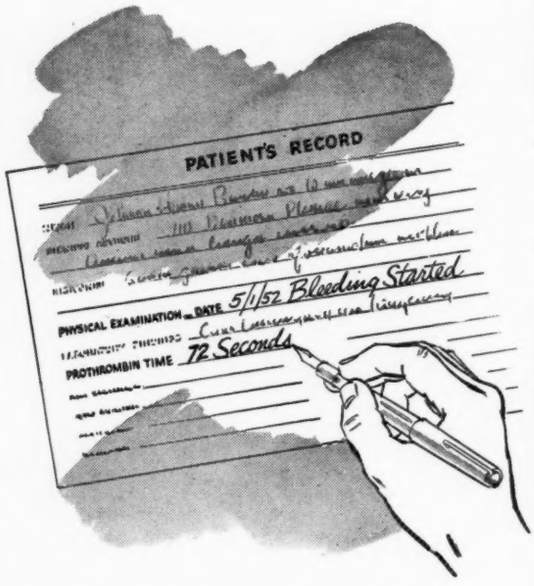
Tubes of 1 oz., 2 oz., 4 oz., and 1 lb. jars.

*write for* **samples** *and literature*

**DESITIN CHEMICAL COMPANY**
**70 Ship Street • Providence 2, R. I.**

1. Behrman, H. T., Combes, F. C., Bobroff, A. Leviticus, R.: Ind. Med. & Surg. 18:512, 1949.
2. Turell, R.: New York St. J. M. 50:2282, 1950.
3. Heimer, C. B., Grayzel, H. G., and Kramer, B.: Archives Pediat. 68:382, 1951.

# New—The Most Reliable Antidote for Anticoagulant-induced Hypoprothrombinemia




*Excessively long prothrombin times and/or typical clinical signs indicate the need for* MEPHYTON.

MEPHYTON—Vitamin $K_1$—in emulsion form promptly and effectively reverses the dangerously prolonged prothrombin time that may be induced by Dicumarol®-type anticoagulants. *Note these advantages:*

- Action is unfailing.
- Completely free of side effects.
- Prothrombin time reversed within 4 to 12 hours.
- Cessation of hemorrhage usually within 3 to 6 hours.

**INDICATIONS:**

Anticoagulant-induced hemorrhage or dangerously prolonged prothrombin time; to assure safe therapeutic levels in anticoagulant therapy.

Hypoprothrombinemia immediately prior to surgery.

Certain liver diseases.

**SUPPLIED:**

1-cc. ampuls, 50 mg. per cc. Boxes of 6.

Emulsion of

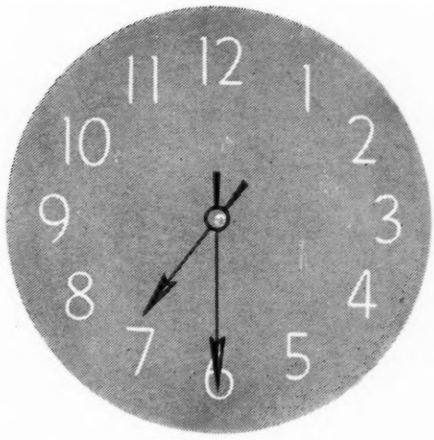
## MEPHYTON*

(Emulsion of VITAMIN $K_1$, MERCK)

**MEPHYTON is the trade-mark of Merck & Co., Inc. for its brand of Vitamin $K_1$.*

*Research and Production for the Nation's Health*

MERCK & CO., INC.
*Manufacturing Chemists*
RAHWAY, NEW JERSEY
In Canada: MERCK & CO. Limited—Montreal



# habit time

● Habit Time of Bowel Movement—not merely relief of constipation—is secured by proper use of Petrogalar.

Petrogalar promotes development of normally hydrated, comfortable and easily passed stools.

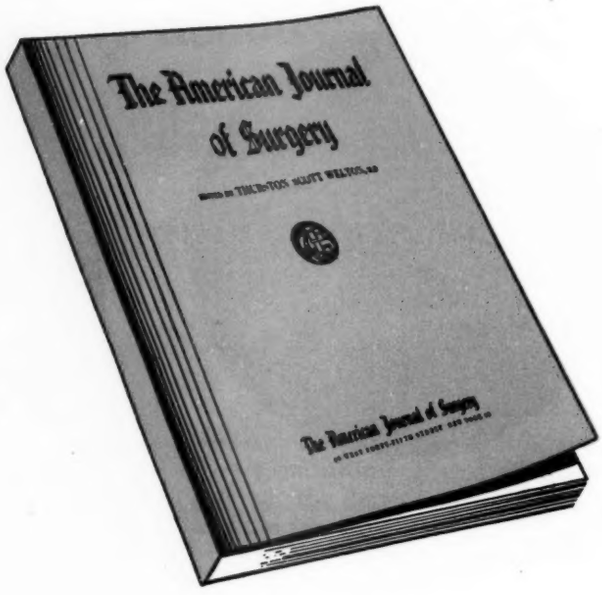
Once achieved, the normal bowel habit may often maintain itself even though the dosage of this adjuvant is slowly tapered off.

## PETROGALAR®

AQUEOUS SUSPENSION OF MINERAL OIL, PLAIN

Supplied: Bottles of one pint

Wyeth®

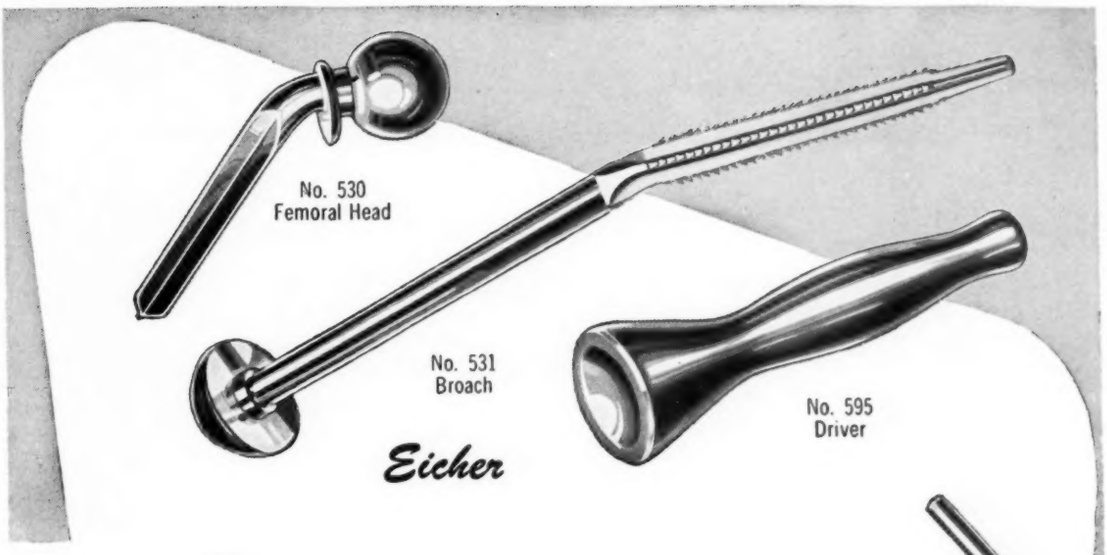



FOR
Christmas . THE IDEAL GIFT FOR
YOUR COLLEAGUE OR DOCTOR FRIEND

A practical journal built on merit that any doctor will take pride in having in his library—beautifully printed and illustrated—a publication that will provide both pleasure and inspiration.

The American Journal of Surgery
49 West 45th St. New York 36

Yearly Subscription $12.00 U.S.A.
Canada and Pan-American Countries $13.00 Foreign $15.00




Eicher

Zimmer
Prosthetic Heads,
Tools, and Instruments
Successfully
Used in Hundreds
of Cases

Naden-Rieth

Minneapolis

Sole Source of Genuine Zimmer Products

Zimmer
MANUFACTURING CO., WARSAW, IND.

## *Sleep That Makes the Darkness Brief*

When tired limbs and overbusy minds cause restlessness and insomnia, a bedtime dose of 'Seconal Sodium' often is indicated. Its hypnotic effect is prompt; relaxation and sleep are quick to follow. Because of the brief duration of action, the patient awakens refreshed, well rested.

*Eli Lilly and Company*
*Indianapolis 6, Indiana, U. S. A.*

Lilly

***For a sound night's sleep, prescribe***

PULVULES

# 'Seconal Sodium'

(SECOBARBITAL SODIUM, LILLY)

The American Journal of Surgery

Copyright, 1952 by The American Journal of Surgery, Inc.

A PRACTICAL JOURNAL BUILT ON MERIT

Sixty-first Year of Publication

VOL. LXXXIV DECEMBER, 1952 NUMBER SIX

# Editorial

## THE VALUE OF TRAVEL

FOR the past thirteen years I have been writing a column of travelogues concerning visits to the various medical centers of America, Canada and Europe; however, these travels began many years prior to this, as a result of advice of the late William J. Mayo. He said, "Whenever I hear of anything in a medical way that sounds good, I travel across the country or the seas to find out about it."

It has occurred to me, as one who has tried to follow that advice, that an editorial on this subject might be of more value to the young surgeons than a dissertation on the technic of some surgical procedure. It has been my experience that many of the young surgeons with whom I come in contact are extremely well versed in the correct technic to be followed in performing a total gastrectomy or the advantages of silk or cotton but are handicapped by the inexperience of having done their studying and observing under one group of teachers. The long periods of preparation required to secure an American Board membership is such a severe financial strain that the young surgeon has little time or money to spend on travel.

Once started on his career he often has heavy debts to pay, a family to raise, a home to be paid for, insurance, an office, a car and many other obligations. So the years pass. He may attend an annual meeting of the state medical society or even become a member of one of the large surgical organizations, but too often he just sits and is content to perform an operation now and then, read a journal or two, and build up a practice.

What is he missing? Almost everyone agrees that travel has a broadening influence; that most of the time we are too close to the forest to see the trees; that, when we get a thousand or so miles away from home, we have a different aspect on things at home. It takes one out of that rut into which everyone falls who fails to leave his backyard.

In talking with many surgeons it seems to be a universal experience that the most valuable points they learn are not obtained from listening to a man speak, but rather from sitting and visiting with him or watching him at work. Most of us have had the experience of hearing some splendid orations and fine statistical reports that sounded intriguing, only later to be disappointed on observing the speaker perform surgery. We have also had the opposite experience of seeing rather mediocre speakers and writers skillfully perform surgical procedures.

One may travel a thousand miles and yet acquire but a single valuable point in the performance of an operation; yet this one point may mean the difference between life and death for a patient, the difference between excellence and mediocrity for the surgeon.

Where should the young surgeon go? That would depend to some extent on the time available and his financial position. Those who have not been able to secure their Boards should certainly allow some time for postgraduate study, such as at the Cook County Postgraduate School or at Pennsylvania, Michigan, New York or other institutions offering these courses. For shorter periods the clinics held by the

Mayo, Cleveland and Lahey groups, among others, are of great assistance. Then one can go from coast to coast and everywhere find great surgeons and teachers, a few day's contact with whom cannot help but be an inspiration and stimulation to a young surgeon to go home and do better. Among the many I have visited with profit are: Drs. Karl Meyer and Raymond McNealy, Chicago; Dean Sauer, the Bartletts, Evarts Graham and Vernon Mastin, St. Louis; Henry Cave and Herbert Meyer, New York; Claude Hunt, Kansas City, Mo.; Alton Ochsner, Mims Gage and Urban Maes, New Orleans; Emile Holman, H. Glenn Bell and Robertson Ward, San Francisco; Gordon Fahrni and Lyon Appleby, Vancouver; Gavin Miller, Montreal; Robert Sanders, Memphis; Harry Bacon, the Jacksons, Wayne Babcock and the Behrends, Philadelphia; Gordon Murray and Robert Janes, Toronto; Frederick Coller, Ann Arbor; William Kroger and Eric Larson, Los Angeles; Edward Churchill, Leland McKittrick, Richard Cattell, Samuel Marshall and Frank Lahey, Boston; William Rienhoff, Baltimore; Everett Evans and I. A. Bigger, Richmond; T. C. Davison and Daniel Elkin, Atlanta; and James Hill and Michael DeBakey, Houston. These are but a small number of the many great leaders in surgery in this country and Canada who are more than willing to help the young surgeon.

In my experience the most enjoyable and the most instructive way to make such a surgical odyssey is with a group of fellow surgeons. Such a trip affords unusual advantages. If a program is requested and arranged weeks or months in advance, a great deal may be observed and learned from a brief visit. A rather intimate contact is made available to an entire staff, and the group itself may profit from its own social affairs and discussions. As a member of the Wisconsin Surgical Travel Club, a group composed of twelve members and three guests, it has been possible to visit most of the large medical institutions, schools and hospitals on the continent not only once but in some instances several times. The profit, not only in medical knowledge but also in friendships established, has been immeasurable to all the members. A meeting is held once a year within the state at a different city each time, at which one of the members is the host.

In starting such a travel club a group of young surgeons might at first confine their travels to merely visits within their state and then in time gradually broaden their trips. With the remarkable developments in air travel one can easily foresee that a week's visit to Europe may well be contemplated in the near future. In this respect it may be said that European surgeons long accustomed to visiting Americans are most cordial and courteous to the visitor.

Without question, most older surgeons would agree that an invaluable part of their medical training had been medical travels, and their only regret would be that they had not done more of it.

ARNOLD S. JACKSON, M.D.

# Original Articles

## THE EARLY DIAGNOSIS AND PREVENTION OF POSTOPERATIVE THROMBOEMBOLISM*

PAUL M. NEUDA, M.D.
*New York, New York*

LITTLE is known about the fundamental processes involved in postoperative thrombosis and embolism. It is therefore not surprising if new findings concerning the etiology, pathology, therapy and prophylaxis are confusing. There are a number of distinct questions in this problem which must be discussed and answered before any approach to the problem as a whole can be found. These questions are:

(1) Since thromboses occur only in a few of the patients subjected to the same surgical procedure, what is the cause of the thrombosis in these individuals?

(2) Since postoperative thromboses are not always followed by embolism, what causes the thrombosis to become detached?

(3) Since in some cases thrombosis and embolism follow each other with the apparent characteristics of a uniform bi-phasic reaction, what constitutes the link between them?

(4) Since spontaneous thrombosis after operation is so peculiar in origin and course, is it to be regarded as the ordinary type of thrombosis or is it of a special not yet clearly defined type? If the latter is true, what differentiates it from the ordinary type?

(5) Since embolism strikes so unexpectedly and even thromboses may be wholly unrecognized, an effort must be made to detect any sign of a tendency to thrombosis which may develop postoperatively. Where, however, should these signs be sought?

The general view on these questions is the following: postoperative thrombosis is the result of an increased clotting tendency of the plasma, the reasons for which are not known; any case of a major operation may display this tendency; embolism, which is the traumatic detachment of a clot, can be expected to result from any thrombosis; since embolism is the direct consequence of thrombosis, its effective prevention is logically accomplished solely by the prevention of the thrombosis. This is best done by anticoagulants such as dicumarol® and heparin.

It must be admitted, first of all, that the use of an anticoagulant is an efficient means of prophylaxis. It is not surprising, therefore, that this method is in general use. However, we must not overlook the fact that by the use of an anticoagulant the whole mechanism of clotting in spontaneous thrombosis is obscured. It is true that the anticoagulant incapacitates the clotting mechanism. This does not prove, however, that the drug was effective against the primary cause of spontaneous thrombosis, nor does it prevent the detachment of a clot already formed.

The author, based on his work in this field, would answer the aforementioned questions in the following way:

(1) The cause of postoperative thrombosis is to be sought in the constitutional peculiarity of the individual manifesting this tendency. This peculiarity is produced by an antigen from the opened tissues entering the blood stream. After surgical incision, an exchange of tissue fluid takes place with the blood, as the result of which a reaction occurs which is immunologic in character and is therefore followed by the formation of an antibody. As antibodies usually have agglutinating properties, this antibody produces agglutination of the platelets. Thrombokinase released by the agglutinated platelets then causes coagulation of the plasma.

(2) Postoperative embolism is not the consequence of all preceding thromboses but the consequence of a special type of thrombus

* From the Achelis Laboratory, Lenox Hill Hospital, New York, N. Y.

formation, the "detachable" thrombosis. After a thrombus has formed, its further fate will depend on the character of healing. If it is by the normal process of organization and canalization, the thrombus will remain attached to the venous wall; if the healing is abnormal, the thrombus will be frail, loose, "detachable." Trauma undoubtedly may play a role in its detachment. In the typical case, however, the embolism will be spontaneous and not attributable to trauma.

(3) The connective link between postoperative thrombosis and embolism is serologic in nature. In the immunologic response of the blood both agglutinins and lysins are apparently formed, the former leading to platelet agglutination and thrombosis, the latter to lytic action and embolism.

(4) Spontaneous postoperative thrombosis cannot be regarded as a common type of thrombosis. It is to be viewed rather as a thrombosis of a special type that requires further study. We know from Ochsner's[7] distinction between thrombophlebitis and phlebothrombosis that only the latter is usually followed by embolism. From our point of view it is quite clear why it is so. By the term thrombophlebitis, thromboses are described which adhere to the venous wall. By phlebothromboses, however, thromboses are meant which form spontaneously within the blood and have either no connection at all or only a loose one with the vessel wall. The latter are the type of thromboses which form after a major operation. Why postoperative thromboses occur far from the area of operation, i.e., in the lower limb veins, is a phenomenon whose significance is not fully understood. An explanation of this phenomenon will be given later.

(5) Signs possibly useful for the early diagnosis of the postoperative tendency for thrombosis are to be found in the blood.

For all practical purposes all the foregoing statements can be reduced to two: the early diagnosis and treatment of the thrombosis tendency; and the prevention of pulmonary embolism in those cases in which thrombosis has already occurred.

## EARLY DIAGNOSIS AND TREATMENT OF POSTOPERATIVE TENDENCY TO THROMBOSIS

*Rationale of This Investigation.* The starting point in every case of postoperative thrombosis is an incision of certain tissues by a major operation. As the immediate result of this incision two fluids which normally are strictly separated from each other, namely, the tissue fluid and the blood, come into intimate contact. Substances entering the bloodstream from the tissues can not be regarded as simple tissue coagulins. If this were so, the blood would coagulate immediately and within the area of operation. It coagulates, however, after a few days and at a distance from the area of operation. The mechanism must therefore be regarded as different. It must be assumed that in certain cases the substances derived from the opened tissues are antigenic in character and capable of producing an immunologic reaction on the part of the blood. This means formation of an antibody with, first of all, agglutinating properties. Primary platelet agglutination is then followed by secondary plasma coagulation. The three blood procedures chosen for this study group themselves around the central phenomenon in the formation of a spontaneous thrombus, which is platelet agglutination.

*Method of Investigation.* The blood was studied by the following three procedures: the agglomerability of the platelets; the erythrocyte sedimentation rate (ESR); and the plasma-red cell mass ratio determined on two different occasions: first, just prior to operation, usually on the preceding evening and second, on the fourth postoperative day. The first determination was made to procure baseline data on the supposed "resting" state of the blood. Since only a major operation was performed between these two determinations, this operation was tentatively considered as the origin of any change in these signs. (Table III lists the results of these three procedures in fifty major operations performed at the Lenox Hill Hospital.)*

*Discussion of the Blood Procedures.* Platelet agglomerability is the natural expression of platelet stickiness and agglutinability. Because of the simplicity of the test and the ease with which a change in agglomerability can be determined, this could be the most valuable sign of an increased tendency to thrombosis. The platelets were observed in a fresh wet prepa-

* Forty-five of the cases were referred by Dr. C. Eggers, three by Dr. O. Pickhardt and one by Dr. M. Donahue. I am deeply indebted to Dr. Eggers who followed with unfailing interest and encouragement the progress of this work.

ration of a drop of oxalated blood on a slide, covered with a cover slip. Low, medium and high platelet agglomerability were easily ascertained.

The significance of the ESR lies in the fact found by the author[4] that human sera exhibit-

TABLE I

| Additional Human Serum | Rabbit Ambo-ceptor | Sheep's Blood | Agglutination |
|---|---|---|---|
| — | " | " | ± |
| All sera 1:10 | — | " | Nearly negative |
| 6263 | " | " | + + + |
| 1611 | " | " | + + + |
| 7083 | " | " | + + |
| 4451 | " | " | + + |
| 2650 | " | " | + + + |

ing a high sedimenting power are capable of instantly and markedly raising the strength of any agglutinating system simultaneously present in the suspension. This was shown in various experiments using various agglutinating systems. Table I records the results of such an experiment.

In the light of this experiment the sudden and marked spontaneous increase in the ESR which occurs almost universally on the fourth postoperative day (Table III) can be expected to increase the strength of any agglutinin already present in the blood.

The significance of the plasma-red cell mass ratio lies in the fact, also found by the author,[6] that there is an intimate relation between the plasma volume and the ESR. An artificial increase in the amount of plasma by diluting the blood with plasma will instantly increase the ESR. Dilution of the blood with saline will not produce the same result. This increase in the ESR will be directly proportional to the original sedimenting power of the blood. In the following experiment (Table II) the original ESR was definitely low; the more significant then is the marked increase in the ESR after addition of plasma.

A change in the plasma-red cell mass ratio due to an increase in the plasma volume, has been observed in many cases after operation. This increase in the plasma volume postoperatively can be viewed from a different angle. A small red cell mass and a large plasma volume is commonly called anemia. In the analysis presented here, however, emphasis is not laid upon the decreased red cell mass (oligocythemia) but on the increased plasma volume (hyperplasmia). It is not difficult to infer that a primary and absolute increase in plasma volume can occur, inasmuch as changes

TABLE II

| Erythrocyte Sedimentation Rate | 15′ | 30′ | 45′ | Hematocrit (%) |
|---|---|---|---|---|
| Unchanged blood | trace | 2 mm. | 6 mm. | 45 |
| 0.5 plasma added to 1.5 cc. blood | 9 mm. | 36 mm. | 45 mm. | 33 |
| 0.5 saline added to 1.5 cc blood | 1 mm. | 2.7 mm. | 6 mm. | 33 |

in the quality of the plasma actually take place after operation. For, as can be seen in Table III, there are a number of cases which exhibited an unchanged red cell mass and plasma volume after the operation, some having an increased red cell mass and reduced plasma volume, but in which nevertheless the ESR has markedly increased on the fourth postoperative day. Since the capacity of increasing the ESR resides in the plasma, the plasma in the aforementioned cases must have changed in quality. It is highly suggestive to assume that these changes in the quantity and/or quality of the plasma postoperatively are due to the entrance of tissue fluids into the blood. (Table III.)

*Comment.* It will be noted that decisive changes have occurred in most of the cases by the fourth postoperative day. These changes varied considerably from case to case, but were so marked in some that a physical state of the blood which would favor thrombosis might well be anticipated. This does not mean that a thrombus due solely to these changes has occurred or will necessarily take place. An agglutinating substance causing platelet agglutination is still necessary. The blood properties analyzed in this study are non-specific factors which merely assist the specific agglutinating substance. However, these three blood properties, although differing regarding specificity from the presumed basic agglutinating substance, have nevertheless a similar significance regarding the outcome.

On the basis of this study, therefore, if on

TABLE III

| No. | Patient | Operation | Date | Blood Reports | | Platelet Agglomerability | | Erythrocyte Sedimentation Rate (mm.) | | Hematocrit | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Before | After | Before | After | Before | After | Before | After |
| 1 | H. U. | Cancer ventriculi | 5/20/48 | 5/18 | 5/24 | Medium | Medium | 23 | 37 | 45 | 45 |
| 2 | C. O. | Cancer of the breast | 5/28/48 | 5/26 | 6/1 | Very low | High | 37 | 51 | 46 | 39 |
| 3 | F. A. | Cancer of the breast | 6/2/48 | 5/29 | 6/7 | High | Low | 17 | 45 | 35 | 34 |
| 4 | P. A. | Cancer ventriculi (scirrhus) | 6/26/48 | 6/23 | 6/30 | High | High | 45 | 44 | 32 | 60 |
| 5 | L. E. | Cancer pancreatis; cholecystectomy | 10/29/48 | 10/28 | 11/1 | Low | High | 20 | 11 | 51 | 55 |
| 6 | G. R. | Teratoma of left ovary Salpingo-oophorectomy | 11/15/48 | 11/11 | 11/19 | Low | Medium | 14 | 51 | 42 | 37 |
| 7 | O. N. | Dilatation and currettage; amputation of distal tip of cervix | 11/12/48 | 11/11 | 11/16 | Medium | High | 13 | 49 | 40 | 28 |
| 8 | C. G. | Herniorrhaphy | 11/16/48 | 11/15 | 11/19 | High | High | 11 | 40 | 44 | 42 |
| 9 | A. I. | Cholecystectomy | 11/17/48 | 11/15 | 11/20 | Low | High | 15 | 48 | 44 | 37 |
| 10 | H. R. | Intestinal adhesions; perirectal fistula | 11/18/48 | 11/16 | 11/22 | High | High | 22 | 50 | 38 | 37 |
| 11 | F. K. | Perirectal fistula | 11/23/48 | 11/22 | 11/27 | Low | Medium | 25 | 39 | 48 | 42 |
| 12 | J. N. | Cholecystectomy | 12/2/48 | 12/2 | 12/10 | Very low | Medium | 17 | 47 | 42 | 38 |
| 13 | G. S. | Dilatation and currettage; appendectomy | 12/6/48 | 12/6 | 12/10 | Medium | High | 19 | 55 | 40 | 35 |
| 14 | G. L. | Cholecystectomy | 12/7/48 | 12/6 | 12/11 | Medium | Medium | 21 | 40 | 42 | 42 |
| 15 | W. L. | Cancer recti, resection | 12/16/48 | 12/15 | 12/20 | Very low | Very low | 19 | 42 | 28 | 35 |
| 16 | M. O. | Cancer pancreatis; cholecystoenterostomy | 12/19/48 | 12/19 | 12/25 | High | High | 21 | 40 | 47 | 44 |
| 17 | W. M. | Cancer recti, resection | 12/30/48 | 12/28 | 1/3 | Medium | Low | 27 | 40 | 48 | 45 |
| 18 | O. O. | Cholecystectomy | 12/28/48 | 12/28 | 1/2 | Very low | Medium | 27 | 43 | 43 | 42 |
| 19 | K. N. | Hysterectomy | 1/3/49 | 12/30 | 1/6 | Medium | High | 11 | 32 | 44 | 44 |
| 20 | U. R. | Herniorrhaphy | 1/4/49 | 1/3 | 1/8 | Very low | Very low | 5 | 33 | 50 | 46 |
| 21 | B. M. | Bilateral ovarectomy | 1/5/49 | 1/4 | 1/10 | Medium | High | 14 | 27 | 40 | 40 |
| 22 | M. R. | Herniorrhaphy | 1/10/49 | 1/9 | 1/14 | Low | High | 4 | 21 | 43 | 42 |
| 23 | B. N. | Appendectomy; herniorrhaphy | 1/12/49 | 1/12 | 1/17 | Low | Medium | 11 | 41 | 49 | 46 |
| 24 | D. P. | Hysterectomy | 1/10/49 | 1/9 | 1/14 | Very low | High | 24 | 54 | 37 | 36 |
| 25 | H. K. | Hysterectomy; appendectomy | 1/14/49 | 1/13 | 1/18 | Low | High | 25 | 58 | 36 | 31 |
| 26 | F. N. | Cancer of cervix | 1/15/49 | 1/14 | 1/18 | Medium | High | 33 | 55 | 40 | 33 |
| 27 | B. R. | Cholecystectomy | 1/15/49 | 1/14 | 1/19 | Medium | High | 38 | 51 | 43 | 40 |
| 28 | P. E. | Cancer recti, resection | 1/19/49 | 1/18 | 1/20 | Low | High | 25 | 46 | 37 | 39 |
| 29 | W. R. | Adenocarcinoma coeci | 1/20/49 | 1/19 | 1/24 | Medium | Low | 22 | 27 | 33 | 37 |
| 30 | K. R. | Diverticulitis of sigmoid; resection | 1/26/49 | 1/19 | 1/31 | None | Low | 12 | 45 | 42 | 40 |
| 31 | I. M. | Cholecystectomy | 1/21/49 | 1/20 | 1/25 | High | High | 33 | 48 | 38 | 38 |
| 32 | Y. I. | Cancer ventriculi | 2/25/49 | 2/24 | 2/27 | High | Low | 26 | 33 | 47 | 46 |
| 33 | E. R. | Hemorrhoidectomy | 2/28/49 | 2/27 | 3/4 | Medium | High | 6 | 17 | 37 | 37 |
| 34 | N. S. | Colporrhaphy | 3/2/49 | 3/2 | 3/7 | Medium | High | 8 | 26 | 47 | 43 |
| 35 | H. N. | Herniorrhaphy | 3/3/49 | 3/2 | 3/7 | Low | Medium | 15 | 15 | 45 | 48 |
| 36 | M. R. | Cystic mastitis; excision | 3/15/49 | 3/14 | 3/18 | Low | High | 4 | 11 | 44 | 48 |
| 37 | V. I. | Cancer coli; colostomy | 4/6/49 | 4/5 | 4/11 | High | High | 30 | 29 | 35 | 34 |
| 38 | L. W. | Herniorrhaphy | 4/14/49 | 4/9 | 4/18 | High | Medium | 44 | 44 | 42 | 40 |
| 39 | B. T. | Cancer ventriculi; partial resection | 4/12/49 | 4/11 | 4/21 | High | High | 46 | 54 | 41 | 35 |
| 40 | V. N. | Cancer of sigmoid; resection | 4/26/49 | 4/25 | 5/3 | High | Low | 4 | 35 | 46 | 43 |
| 41 | F. Y. | Duodenal ulcer | 4/28/49 | 4/27 | 5/3 | High | High | 5 | 42 | 46 | 44 |
| 42 | G. O. | Nephrectomy | 5/12/49 | 5/10 | 5/16 | High | High | 22 | 54 | 44 | 37 |
| 43 | S. E. | Cholecystectomy | 5/24/49 | 5/23 | 5/31 | High | Medium | 29 | 41 | 39 | 41 |
| 44 | P. U. | Cancer of the breast | 5/25/49 | 5/24 | 5/31 | High | High | 12 | 53 | 36 | 29 |
| 45 | I. S. | Cancer of the sigmoid; resection | 6/3/49 | 6/2 | 6/7 | High | Medium | 20 | 41 | 43 | 43 |
| 46 | C. O. | Cholecystectomy; appendectomy | 6/8/49 | 6/7 | 6/13 | High | High | 54 | 61 | 36 | 32 |
| 47 | M. I. | Cholecystectomy | 6/10/49 | 6/8 | 6/16 | High | Medium | 36 | 53 | 39 | 38 |
| 48 | S. T. | Cholecystectomy | 6/15/49 | 6/14 | 6/20 | Very low | Medium | 12 | 43 | 42 | 45 |
| 49 | R. O. | Cholecystectomy | 6/17/49 | 6/16 | 6/21 | Medium | Medium | 5 | 49 | 43 | 43 |
| 50 | L. E. | Adenocarcinoma recti; resection | 6/22/49 | 6/21 | 6/28 | Very high | High | 34 | 59 | 46 | 34 |

the fourth postoperative day there has been a marked increase in platelet agglomerability, the ESR and the plasma volume, a physical state of the blood favoring thrombosis may exist. It will be noted from Table III that these changes are highly individual in character and vary in degree. This is in conformity with general experience and also with the leading concept of this article, that the thrombosis tendency does not appear in all operated patients, but only in a few. In conclusion we can say that there are certain blood properties related to platelet agglutination which are to a varying degree changed and intensified following a major operation. These changes take place spontaneously and with great regularity. They are irrespective of the character of the abdominal operation, thus indicating their

possible connection with the circumstances and conditions of the surgical opening itself. These investigations, if confirmed, merit further study since they may contain the potentiality of the early diagnosis of a tendency to thrombosis and even of the treatment of this tendency by measures directed against the nonspecific factors favoring platelet agglutination.

It is an integral part of the reasoning in this new concept of the pathologic and prophylactic therapy of pulmonary embolism that the factor which is supposed to provide the thrombus with the characteristics of "detachability" cannot be identified simply by the postoperative increase in a general thrombosis tendency. This view gets strong support from the fact that postoperative thromboses and embolisms originate preferably far from the area of operation, i.e., in the veins of the lower limbs.

In the foregoing we have discussed the problem of postoperative thrombosis and embolism from the point of view of detecting certain changes in the properties of the blood following a major operation, which might be connected with an increased tendency to thrombosis. Any assumed danger of thrombosis could be counteracted at this time by an agent such as dicumerol. If thrombosis was entirely prevented, embolism of course would not ensue. This reasoning however does not satisfactorily fulfill the requirements for a complete analysis of the problem of pulmonary embolism. In the following the prevention of pulmonary embolism when thrombosis has already occurred is discussed.

### THE PREVENTION OF PULMONARY EMBOLISM WHEN THROMBOSIS HAS OCCURRED

This question is much more complicated than the foregoing. During the development of the thrombus up to its detachment, new factors constantly add to the complexity of the clinical phenomena. Many observers are inclined to consider pulmonary embolism the natural consequence and logical result of any preceding thrombosis, only facilitated by trauma. It is for this reason that dicumerol as a routine postoperative prophylaxis is being applied to all cases. This reasoning, however, and the general use of the anticoagulants, is not justified. In the first place thrombosis after operation is rather a rare occurrence; secondly, embolism is still rarer than thrombosis; thirdly, and most important of all, attention is diverted from the fact that not any thrombosis, but only a peculiar thrombosis, leads to embolism, namely, the frail, loose, "detachable" thrombus. Consequently, if the detachability of the postoperative thrombus could somehow be prevented, embolism and its dangers would become improbable.

There must, therefore, be a local factor in the veins of the lower extremities which exerts a potent influence both in thrombus formation and in thrombus "detachability," or fitness for embolization. This factor must be variable, since not all thrombi forming in these veins embolize. Apparently, the outcome depends upon the irreversibility of the situation in these veins. According to the studies pursued by the author for many years[5,6] the following mechanism seems to be causative both in the formation and in the later detachment of the thrombi formed in the lower limb veins.

The veins of the lower extremities differ from almost all other veins in the human body by distinct morphologic and physiologic peculiarities. Veins in general are nourished entirely by the vasa vasorum, in contradistinction to arteries. These small capillary channels supply the necessary oxygen to the tissues of the venous wall. They arise from outside the vein and penetrate the whole thickness of the venous wall to the intima. Arteries, on the other hand, are nourished mainly by diffusion of oxygen from the arterial blood they carry. Vasa vasorum exist only in the outer layers. According to Schaffer,[8] "The larger blood vessels are nourished by the so-called vasa vasorum. These show a different behavior in arteries and veins. Since the arteries in their inner layers are washed by the arterial blood and are nourished by it, the oxygen carrying capillaries piercing through the adventitia reach only the outer layers of the media. In the veins, however, the nourishing capillaries penetrate as far as close to the endothelium of the intima; the valves of the veins contain at their roots a rich capillary network." According to Maximow and Bloom,[2] "The walls of all arteries and veins with a caliber greater than 1 mm. are provided with their own blood vessels, the vasa vasorum. These originate from the adjacent small arteries, and form a dense capillary network in the adventitia. In even the larger arteries, they do not penetrate further than the external layers of the media. In the veins, however, they are

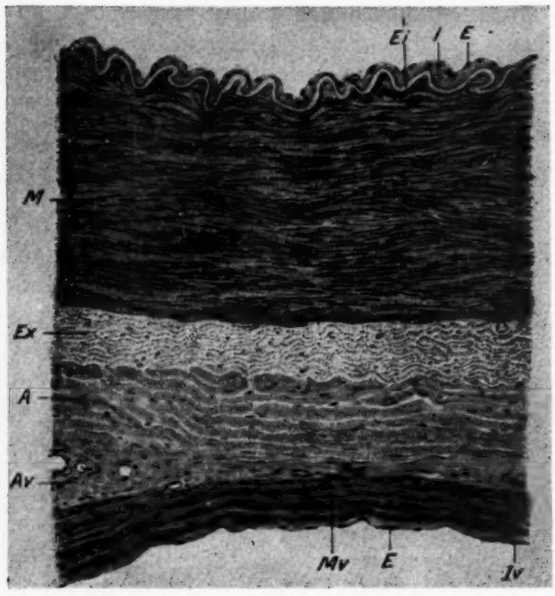



FIG. 1. Part of a crosscut through the radial artery and vein. (A) adventitia of the artery passing into that of the vein (Av); (E) endothelium; (Ei) elastica intima; (Ex) elastica externa; (I and Iv) intima of the artery and vein; (M and Mv) media of the artery and vein.

in general more abundant and may even penetrate to the intima."

Veins and arteries in general differ also essentially in structure. Arteries, as compared with similarly sized veins, have an elastico-muscular coat of a strength that veins never have. Veins, therefore, if cut through, easily collapse, while arteries remain open. According to Schaffer, "The musculature of the veins in man, because of his upright posture, is only weakly developed or even fully missing in the veins of the head and of the upper half of the body . . . Contrary to this, the veins of the extremities and of the lower half of the body are richly provided with muscles and may have . . . besides circular bundles also outer and inner longitudinal bundles." According to Maximow and Bloom, "In veins of medium caliber, the tunica media is much thinner than in arteries and consists mainly of circular smooth muscle fibers separated by many longitudinal collagenous fibers and a few fibroblasts." According to Bailey[1] "The media (in the medium sized veins) is thin as compared with that of arteries of the same size . . . The media is thickest in the veins of the lower extremity where it resembles more nearly that of an artery." This general difference in structure between arteries and veins is illustrated in Figure 1.

The peculiarity of the lower limb veins lies, therefore, in the fact that their nourishment is similar to all veins and yet their structure resembles that of an artery. This means that they receive their entire oxygen supply by fine capillary channels, the vasa vasorum, which, however, have to pierce through a venous wall with a muscular structure similar to that of an artery, in order to reach the intima. This is illustrated by the structure of the vena saphena. (Fig. 2.)

The structure of the lower limb veins is explained by their function. They have to bear, in the upright posture of man, the hydrostatic pressure of the blood column ascending against gravity towards the heart. These veins are physiologically equipped to serve this purpose. However, in the supine position assumed by a patient after a major operation the lack of an adequate hydrostatic pressure exerted on the venous wall, combined with a lowered blood pressure, convert the previously described discrepancy between nourishment and structure into a situation fraught with grave danger. Under these conditions the veins are in a collapsed state and the vasa vasorum are compressed between the heavy muscular layers through which they traverse. The oxygen supply to the venous wall and especially to the intima must necessarily be reduced or completely shut off with consequent anoxic disturbances in the tissue cells. In several cases the author has found an increased lactic acid content in the blood of these veins postoperatively. This finding may have a great bearing on both thrombus formation and its looseness or "detachability."

The complex characteristics of thrombus formation and healing are not and cannot be assumed to be the same both in quality and degree in all cases. On the contrary, it must be assumed that the pathologic conditions arising from the morphologic facts are variable in degree, for the determining factors are highly individual. The postoperative situation in the lower limb veins will depend on a number of factors such as: the size of the muscular layer, the thickness of the venous wall, the number of vasa vasorum and their distribution, the sensitivity of the tissues of the venous wall to anoxia, and other unknown factors.

An understanding of the mechanism under-

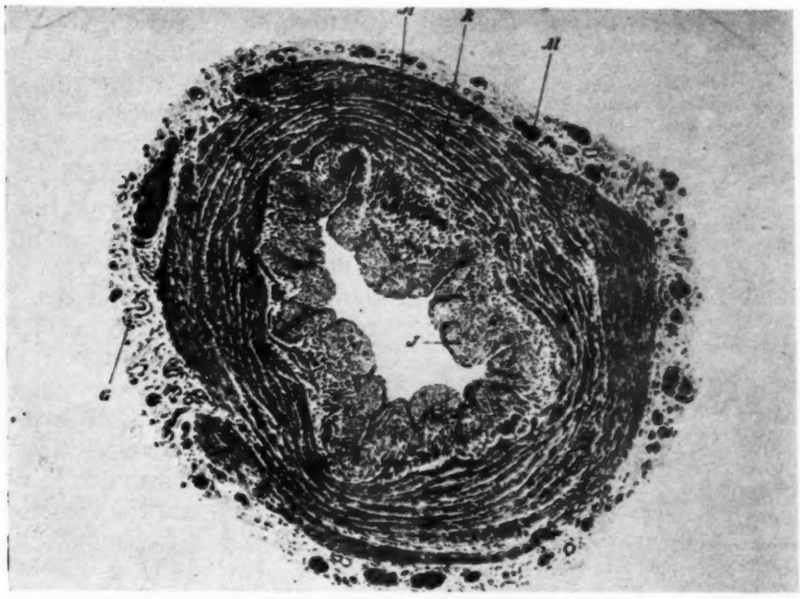


FIG. 2. Crosscut through a small branch of the vena saphena of the calf. (Al) outer longitudinal muscles; (G) vessels of the adventitia; (J) intima; (Jl) inner longitudinal muscles; (R) ring-muscles of the media.

lying the formation of thrombi and their improper healing in the veins of the lower extremities provides the clue to its prevention, no matter what actually precipitates the clot. It is necessary to counteract the pressure exerted by the venous musculature upon the vasa vasorum, in order to restore and then to maintain the oxygen supply. This apparently can be done, and was done successfully by the author, with an elastic bandage applied with moderate but firm pressure upon the lower limbs, beginning at the ankles and carried upward as far as the knee. The dynamics underlying this procedure are demonstrated in the following experiment. (Figs. 3 and 4.)

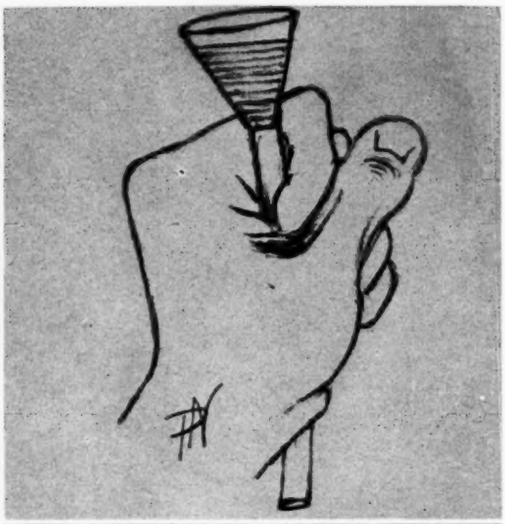
We see in Figure 3 a fist tightly holding a rubber tube to which a funnel containing water is attached. Due to the firm grip of the fingers the water does not pour out. In Figure 4 the grip upon the tube by the first hand is counteracted by the pressure of a superimposed second hand. As a result the fist opens and the water pours through the tube.

The tube represents the vasa vasorum. These thin arterial channels are compressed by the heavy muscular coat in the collapsed veins. The fist grasping the tube represents the muscular layer. An elastic bandage plays the same role as the pressure of a superimposed hand, permitting the vasa vasorum to open.

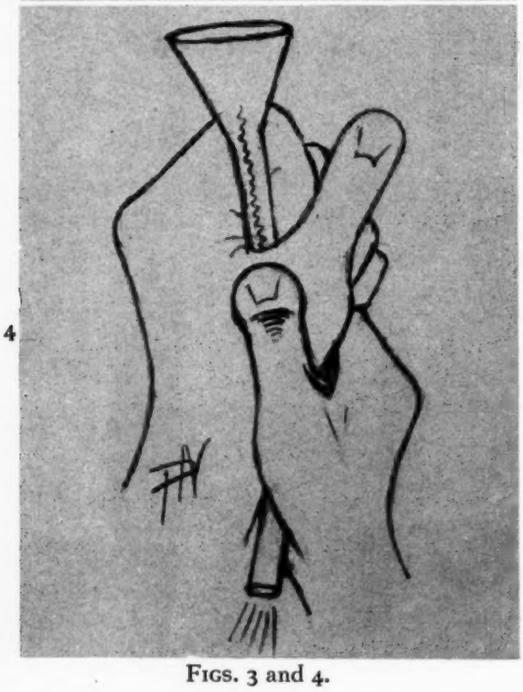
That this procedure is of recognizable value is proved by the disappearance of those signs which are generally considered as heralding an incipient thrombus formation in the lower limbs: (1) Distinct heavyness or flabbiness of the lower limbs; (2) acceleration of the pulse rate without concomitant signs of heart failure; (3) slight low grade fever in the absence of infection; (4) tenderness on pressure over both sides of the Achilles tendon and of the calves.

These signs quickly disappeared in all cases in which an elastic bandage was applied. The purpose of this procedure is to prevent embolism by re-establishing the oxygen supply to the tissues of the venous wall, thus securing normal thrombus healing, and a firmly attached thrombus. It is possible that the same procedure if applied immediately postoperatively before any signs of incipient thrombus formation have appeared, might even prevent the development of a thrombus.

On the basis of this analysis it is apparent that postoperative pulmonary embolism is linked to a preceding thrombosis only insofar as the latter forms a substrate to be embolized. There are a number of circumstances and factors which can both prevent and promote its embolization. This becomes even clearer if the course of events after a major operation is closely followed. The starting point for all the ensuing phenomena is the surgical opening of the tissues. Tissue fluid thus comes into



3



4

FIGS. 3 and 4.

intimate contact with the blood. It is, however, not unaltered, normal tissue fluid which is supposed to be capable of producing an immunologic response on the part of the blood. It must be assumed that it is fluid derived from antigenically altered tissues, since only then would they harbor substances capable of inducing an immunologic response such as the formation of an antibody. This antibody must be very delicate, weak and even transient, for in spite of the marked enhancing effect of the postoperative physical changes in the blood (in ESR and plasma quantity and quality) on any agglutinating system, including that of platelet agglutination, it is not sufficient to produce thromboses in the area of operation. They do, however, form far from the area of operation in the lower limb veins. The structure of the lower limb veins therefore must be a decisive factor, allowing not only the development of anoxic changes in the venous wall, but also a lactic acid formation. Lactic acid in sufficient concentration could conceivably precipitate a thrombus. It does not follow that pulmonary embolism must necessarily ensue. As the result of anoxia further irreversible changes must develop which convert the normal healing of the thrombus by organization and canalization with firm attachment to the venous wall, into one in which the healing is so disturbed that the thrombus is only loosely attached and fit for embolism. Only this latter development is the source of thrombus "detachability" and correspondingly of pulmonary embolism also.

The prevention of pulmonary embolism can therefore be achieved not at one, but at several points: (1) By using an anticoagulant postoperatively in order to incapacitate the blood coagulation mechanism right from the start. Thrombosis would then be prevented and therefore embolism also. (2) By applying elastic bandages to the lower limbs immediately after operation, in order to prevent by physical means thrombus formation, or, if this is not completely achieved, at least its abnormal healing. (3) By applying elastic bandages to the lower limbs in those instances in which the signs of thrombosis have already developed and in which the bandages have not been used prophylactically, in order to promote normal healing and attachment of the clot.

SUMMARY

Observations are presented on certain blood changes which appear spontaneously following a major operation and which suggest the possibility of a rising tendency to thrombosis. The question of pulmonary embolism is discussed, its dependence not merely on thrombosis *per se*, but on special characteristics of this thrombus, i.e., its looseness or detachability, characteristics which are created by special morphologic conditions in the lower limb veins which have not been recognized formerly. The possibilities of an efficient prophylaxis of postoperative pulmonary em-

bolism are shown to exist actually at various points of the complex development of the combined phenomenon of thromboembolism after a major operation.

REFERENCES


1. Bailey's Textbook of Histology, 11th ed. Revised by P. E. Smith and W. Kopenhaver. Baltimore, 1944. Williams & Wilkins.
2. Maximow, A. A. and Bloom, W. Textbook of Histology. Philadelphia, 1942. W. B. Saunders Co.
3. Neuda, P. M. Über Thromboembolie. *Wien. klin. Wchnschr.*, no. 30, 1932; Zur Frage der Thromboembolie. *Deutsche Ztschr. f. Chir.*, 237: 353, 1932; Thromboembolie, ihre Pathologie und Behandlung. *Munchen. med. Wchnschr.*, no. 37, 1934; Zur intravenoesen Lebertherapie der spontanen Thrombose. *Wien. klin. Wchnschr.*, no. 37, 1937; Treatment of spontaneous thromboembolism with intravenous liver injections. *M. Rec.*, 154: 69–71, 1941.
4. Neuda, P. M. Untersuchungen ueber Auto (Kaelte) Agglutination, II. *Ztschr. f. Immunitätsforsch.*, 89: 85, 1936.
5. Neuda, P. M. Discussion to a lecture by E. Friedlaender. Soc. of Physicians. Vienna, 1936.
6. Neuda, P. M. The prophylactic problem of postoperative thrombosis and embolism. *M. Rec.*, 163: 177, 1950.
7. Ochsner, A. Intravenous clotting. *Surgery*, 17: 240, 1945.
8. Schaffer, J. Lehrbuch der Histologie. Leipzig, 1922. Verlag Engelmann.


Total gastrectomy has the disadvantage that postoperative esophagitis often results through the regurgitation of intestinal juices in it, made possible by removal of the valvular mechanism at the cardia. These patients complain of substernal distress and usually have to sleep in a semi-Fowler position. However, whenever the gastric cancer permits, these postoperative symptoms may be prevented if a fringe of the gastric fundus is left for anastomosis because then the valvular action at the cardia, which has all the effects of a sphincter, adequately protects the lower esophagus from these irritating effects. (*Richard A. Leonardo, M.D.*)

# VENOUS MESENTERIC THROMBOSIS*

## SUGGESTED ETIOLOGY AND CASE REPORT

JOHN STORER, M.D., PHILIP KAZDAN, M.D. AND JOSEPH L. BILTON, M.D.
*Philadelphia, Pennsylvania* *Cleveland, Ohio*

IN a consideration of mesenteric vascular occlusion one must classify the primary anatomic site as venous or arterial. The subject has been the stimulus for numerous articles,[1–4] but most of these efforts have been concerned with the arterial type of occlusion. The reasons for this are immediately apparent. Arterial occlusion is manifested clinically by a dramatic and sudden catastrophe. The pathologic condition is usually quite clear-cut, while its pathogenesis from predisposing factors to the stage of irreparably infarcted bowel forms a chain of events which is well understood. Mesenteric venous occlusion, on the contrary, does not always fulfill the niceties of cause-effect relationships. The pattern here is less understood, its predisposing factors are often nebulous and its end result confounding. The comparative frequency of these lesions has been reported with marked variation by different authors. Whittaker and Pemberton[5] report that mesenteric venous occlusion is responsible for 27 per cent of all cases of mesenteric vascular occlusion. Giamarino and Jaffe,[6] on the other hand, state that the venous lesion is responsible for 78 per cent of all cases of mesenteric thrombosis. Other observers[7] have placed the figure somewhere between these two extremes.

From the standpoint of frequency, then, one may conclude that mesenteric venous thrombosis is certainly responsible for a high portion of all mesenteric vascular occlusion. We believe that the importance of this lesion has been too infrequently referred to in the present literature.

Mesenteric arterial occlusion and mesenteric venous occlusion are similar only in their end result. The prodromal symptomatology, etiology, predisposing factors and pathogenesis vary markedly. This article is concerned only with the latter entity and accordingly no further mention will be made of the arterial type of lesion.

Warren and Eberhard[8] in 1935 stressed the importance of mesenteric venous thrombosis as an entity and suggested a classification of the disease from an etiologic standpoint. Other authors have been in general agreement with their classification, which follows:

(1) Known infections, i.e., suppurative intra-abdominal lesions; (2) hematogenous factors, i.e., those blood changes which predispose to thrombus formation; (3) trauma to mesenteric veins; (4) mechanical causes, i.e., portal stasis from tumors. This represents a good working classification. Berry and Bougas[9] have added an agnogenic variety. Inclusion of the agnogenic or idiopathic class is necessary in any outline of etiology because of the frequency with which this diagnosis is made. In fifty-three cases of mesenteric venous thrombosis reviewed by Berry and Bougas, eleven, or 20 per cent, fall into this category. The diagnosis of agnogenic venous mesenteric thrombosis is made when there is no indication of the factor or factors responsible for the initiation of the process. These investigators believed in the absence of all other predisposing factors some change in the blood coagulation mechanism was responsible for the insidious development of mesenteric venous thrombi.

When thrombosis occurs in a major tributary or in the main branch of the superior mesenteric vein, there is a resultant hemorrhagic infarction of that area of the small intestine drained by the involved vein. The bowel wall becomes thickened, discolored and edematous. Extravasation of blood into the mesentery may produce obliteration of arterial pulsation, an occurrence which is undoubtedly responsible for the mistaken classification of many cases of mesenteric vascular occlusion as arterial. When the above-mentioned events have transpired, the bowel is no longer viable and resection is necessary.

We are presenting hereinafter a case report of mesenteric venous thrombosis which we believe would ordinarily have been classified as

* From the Huron Road Hospital, East Cleveland, O.

agnogenic. We will attempt, in the discussion to follow, to suggest the manner in which the formation of thrombi was initiated.

CASE REPORT

D. W., a thirty-two year old white man, was admitted to Huron Road Hospital on December 2, 1950. His chief complaint was severe, generalized abdominal pain of forty-eight hours' duration. This has been preceded by a three or four month history of "indigestion," which was occasionally severe but had been, for the most part, mild to moderate in character. With the onset of severe pain forty-eight hours prior to admission, the patient experienced protracted nausea and vomiting. The pain remained generalized over the entire abdomen and was intermittent for the first twenty-four hours. During this time a diagnosis of gastroenteritis was made by his family physician, who prescribed symptomatic treatment. During the following twenty-four hours the pain became much more severe, continuous and completely incapacitating. The patient had had no bowel movements from the time of onset of his acute symptoms.

His past medical history was essentially negative, except for an appendectomy at age twenty. Family history revealed that his mother had died of mesenteric thrombosis. One brother was said to have "bowel trouble."

Physical examination revealed a well nourished and well developed man in acute distress. He was unable to lie on the examining table for more than a few minutes. He periodically arose from the table and moved about in a semiflexed position, holding his abdomen and moaning with pain. There was no cyanosis, jaundice, dyspnea or edema. The patients constitutional symptoms were out of all proportion to the physical findings. Blood pressure was 120/70, pulse 98. Heart and lungs were normal. The only pertinent findings were confined to the abdomen. There was an old healed scar in the right lower quadrant. The abdomen was soft and not distended. There was marked generalized tenderness on palpation; no masses were palpable. No peristalsis was audible. There were no other findings worthy of note.

A flat film of the abdomen revealed a moderate amount of gas in the large bowel, with no evidence of small or large bowel distention. Other laboratory data were as follows: red blood cells, 4,430,000; white blood cells, 19,900; neutrophiles, 85 with slight left shift; lymphocytes, 10; monocytes, 4; eosinophiles, 1. Urinalysis revealed specific gravity, 1.035; albumin, negative; sugar, trace; acetone, two plus; microscopically, one white blood cell and one red blood cell per high power field. Sedimentation rate was 21 mm. (Westergren) at the end of one hour.

Surgery was initiated within one hour of admission. A segment of jejunum 10 cm. in length was found to be the site of hemorrhagic infarction. There was no evidence of volvulus, adhesions or bands. The branches of the mesenteric veins were filled with thrombi, although arterial pulsations were palpated throughout the leaf of the mesentery. This segment of jejunum was considered to be nonviable and was accordingly resected and an end-to-end anastomosis effected. During the operation the patient received 500 cc. of whole blood and 1,000 cc. of 5 per cent dextrose in water. A Levin tube was inserted and the patient returned to his room.

Postoperatively, antibiotics were administered consisting of 300,000 units of penicillin and 500 mg. of dihydrostreptomycin twice a day. Anticoagulant therapy was not begun because of the patient's tendency to ooze dark venous blood from the skin following venipuncture or subcutaneous injection. This phenomenon was exhibited on the first postoperative day. Blood studies revealed: Duke's bleeding time, two minutes, forty-six seconds; Lee-White coagulation time, eleven minutes; platelet count, 150,000. Clot retraction was initial in one hour and complete in two hours. Serum calcium, 9.5 mg. per cent; cholesterol, 120 mg. per cent; total protein 6.0 gm. per cent, 3.5/2.5; chloride, 400 mg. per cent; $CO_2$ combining power, 50.3 volumes per cent; blood sugar, 120 mg. per cent; non-protein nitrogen, 47.5 mg. per cent; urea nitrogen, 28 mg. per cent; creatinine, 1.35 mg. per cent; prothrombin, 70 per cent of normal; potassium, 15 mg. per cent.

On the second postoperative day the patient complained of generalized abdominal pain. This pain persisted and could not be relieved by substantial doses of narcotics. The general condition of the patient grew worse; he became disoriented and irrational. The clinical impression of potassium deficiency was confirmed by electrocardiogram. Parenteral potassium was administered and the electrocardiogram re-

turned to normal. The temperature has risen to 38.5°C. by the fifth postoperative day. Sedimentation rate was 50 mm. per hour; white blood count, 6,450, with 83 per cent neutrophiles, 9 lymphycytes and 8 monocytes. All other laboratory findings were essentially normal. The patient was returned to the operating room on the sixth postoperative day.

At surgery approximately two feet of jejunum adjacent to the previous anastomosis was found to be gangrenous. This area was resected uneventfully.

The patient improved markedly during the next two days, but continued to display numerous areas of ecchymosis over the arms, legs and chest. Oozing of venous blood from the skin following parenteral injections was still present. Blood chemistry returned to normal, prothrombin remained at approximately 70 per cent of normal. Three days postoperatively edema of the left leg with a positive Homan's sign was noted. These symptoms subsided in three days with elevation and Ace bandage, and the patient continued to improve. Anticoagulants were withheld in spite of these findings because of the "hemorrhagic tendency" noted previously. On the eleventh day after the second operative procedure, while sitting in a chair, the patient suddenly collapsed and died of an apparent pulmonary embolus.

An autopsy was performed within two hours after death. (For the sake of brevity, only the description of the pathologic lesions will be given.) The abdomen contained 300 cc. of dark amber fluid. There was some thickening of the serosa and numerous adhesions were noted between the adjacent loops of bowel. The area of anastomosis was noted and found to be intact. The spleen was increased in size and the splenic vein throughout its entire course was dilated and filled with a well formed, adherent, laminated blood clot. There was no involvement of the splenic artery. The superior mesenteric vein was considerably enlarged, in some places measuring 12 mm. in diameter, and was filled throughout its course with an adherent blood clot. The thrombosis extended into the intra- and extrahepatic portion of the portal vein. Thrombi were also seen in the left iliac and femoral veins.

In the right ventricle of the heart a large blood clot was found which extended into the main pulmonary artery and its branches. The embolus had apparently come from the right thigh and leg. This is an interesting finding, since there was no obvious clinical involvement of the right lower extremity at any time. The remainder of the heart was normal. In the lungs a recent infarct 5 cm. in diameter was found. The remainder of the autopsy findings were not pertinent.

Microscopic findings of interest were confined to the pancreas and the thrombi which extended throughout the mesenteric and portal venous system. The parenchymatous pancreatic tissue was abundant and well organized. The interstitial tissue was loose and edematous, with some areas of fibroblastic proliferation and other areas showing infiltration by lymphocytes and a few pus cells. There were also many dilated small ducts and acini which suggested rupture and tissue damage.

## COMMENTS

The pancreatic lesion best suggests a diagnosis of chronic recurrent pancreatitis. In an attempt to ascertain the age of the pancreatic lesion in relation to the thrombi, sections were submitted to several qualified pathologists. There was unanimity in their opinion that the pancreatic lesion predated the occurrence of the thrombi. The consensus was that the pancreatic lesion appeared to have existed for several months while the thrombi appeared to be of two to three weeks' duration.[10,11] Figures 1 to 4 show the large-sized fibroblasts and the paucity of collagen in the vessels, as contrasted with the small rigid fibrocytes and abundant collagen in the pancreas. Frank evidence of chronic pancreatitis is also demonstrated

With these facts in mind the question immediately arises: Is there a relationship between the various forms of pancreatitis and mesenteric venous thrombosis? In a recent article we discussed the relationship of the pancreas to blood coagulation.[12] There is abundant evidence that such a relationship does exist. Recent contributions by Innerfield et al.[13] have shown a parallel between blood trypsin levels and antithrombin titer. In those diseases associated with high trypsin levels, i.e., acute pancreatitis and the acute stage of chronic recurrent pancreatitis, the antithrombin titer rises and with it a hemorrhagic tendency is noted. We believe this phenomenon to be responsible for the "peripheral" hemorrhagic tendencies noted in the case presented. We have been able to demonstrate in a small series

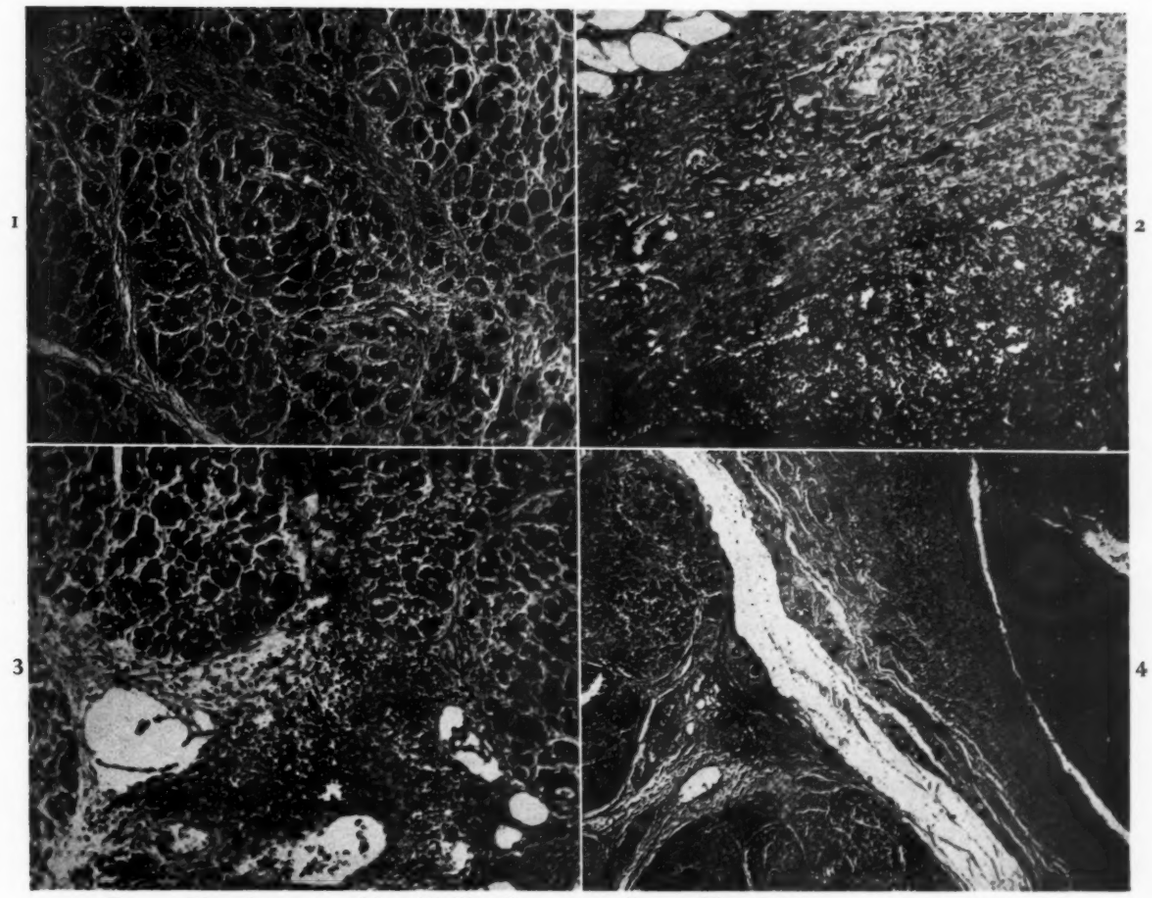



FIG. 1. Chronic pancreatitis with fibrosis, apparently an old process.

FIG. 2. Thrombosis of pancreatic portion of splenic vein.

FIG. 3. Subacute and acute pancreatitis.

FIG. 4. Thrombosis of pancreatic portions of the splenic vein, regional to pancreatic fibrosis.

the prolongation of elevated trypsin levels for several days after the return to normal of serum amylase and serum lipase.[12] Thus in the acute exacerbation of chronic recurrent pancreatitis a high trypsin level may be maintained over a prolonged period.

Innerfield et al. also demonstrated that the immediate effect of intravenous injection of trypsin into dogs was accompanied with immediate depression of plasma antithrombin titer, followed by a secondary and sustained elevation in antithrombin titer. The *immediate* effect of trypsin would then, with the accompanying diminution in antithrombin, predispose to thrombus formation. This, coupled with the known ability of trypsin *per se* to coagulate blood, suggests a rather striking immediate effect on the blood coagulation mechanism.[14]

It seems quite plausible that with the liberation of large amounts of trypsin, as occurs in pancreatitis, the absorption would occur most prominently in the portal system, particularly the veins which drain that segment of small bowel containing the highest concentration of trypsin. The immediate ability of high trypsin titers to coagulate blood directly would then be manifest in these venous tributaries absorbing trypsin in the greatest quantity, i.e., the portal system and especially its intestinal branches. After the initial stimulus to thrombus formation has occurred, the propagation of the thrombotic process in these areas is almost assured.

The pancreatic pathologic condition in chronic recurrent pancreatitis may easily be overlooked. One is forced to speculate as to how many cases of mesenteric venous thrombosis which were diagnosed as idiopathic or agnogenic would have revealed pancreatic disorder if a thorough search had been made for it.

SUMMARY AND CONCLUSIONS

1. Mesenteric venous thrombosis is a clinical entity which occurs more frequently than has been suspected.

2. Mesenteric venous thrombosis is a pathologic entity which is often erroneously diagnosed as its arterial counterpart.

3. The report of a case of mesenteric venous thrombosis with chronic recurrent pancreatitis ending fatally with pulmonary embolus is presented.

4. It is suggested that chronic recurrent pancreatitis by its effect on the blood coagulation mechanism may precipitate thrombosis of the portal venous system.

REFERENCES

1. Chodoff, R. J. Mesenteric vascular occlusion. *Ann. Surg.*, 131: 440–444, 1950.
2. Phillips, J. R. and Stalnaker, P. R. Acute mesenteric occlusion. *Am. J. Surg.*, 71: 287–289, 1946.
3. Musgrove, J. E. and Seybold, W. D. Mesenteric vascular occlusion. *Surg. Clin. North America*, 30: 1063–1071, 1950.
4. Gass, O. C. Mesenteric thrombosis, *Am. J. Surg.*, 75: 279–280, 1948.
5. Whittaker, L. D. and Pemberton, J. Mesenteric vascular occlusion. *J. A. M. A.*, 111: 21–24, 1938.
6. Ciamarino, H. and Jaffe, D. Mesenteric vascular occlusion. *Arch. Surg.*, 45: 647–652, 1942.
7. Anderson, W. A. D. Pathology, p. 833. St. Louis, 1948. C. V. Mosby Company.
8. Warren, S. and Eberhard, T. P. Mesenteric vascular thromboses. *Surg., Gynec. & Obstet.*, 61: 102–121, 1935.
9. Berry, F. B. and Bougas, J. A. Agnogenic venous mesenteric thrombosis. *Ann. Surg.*, 132: 450–474; 1950.
10. Gregory, J. E. Personal communication.
11. Goodsitt, E. Personal communication.
12. Storer, J. and Kazdan, P. The relation of the pancreas to blood coagulation. To be published.
13. Innerfield, I., Angrist, A. Benjamin, J. Plasma antithrombin patterns in disturbances of the pancreas. *Gastroenterology*, 19: 843–855, 1951.
14. Eagle, H. and Harris, T. N. Studies in blood coagulation. The coagulation of blood by proteolytic enzymes (trypsin and papain). *J. Gen. Physiol.*, 20: 543–560, 1936–1937.

# AN EVALUATION OF THE BOLEN BLOOD PATTERN TEST FOR DETECTING CANCER*

ARKELL M. VAUGHN, M.D., WESLEY R. T. METZNER, M.D. AND CORNELIUS M. ANNAN, M.D.

*Chicago, Illinois*

THE need for a simple laboratory procedure to detect the presence of cancer, especially in its early stages, by routine examination of all patients, has been outstanding in the minds of cancer specialists and public health authorities for years. Bolen[1,2] has advocated the gross and microscopic (low power) morphology of dried drops of blood as sufficiently diagnostic to fill this need in many instances. Bolen employs the technic of Goldberger[3] as a rapid bedside test for measuring the blood sedimentation rate. Giron,[4] in 515 cases in Guatemala, closely approximated Bolen's 90 per cent accuracy. Bolen also differentiates "beginning malignancy" from "late malignancy" by this blood pattern test. Our purpose here is an attempt to evaluate this test fairly and to duplicate the results of Bolen in a study of 100 cancer and non-cancer patients.

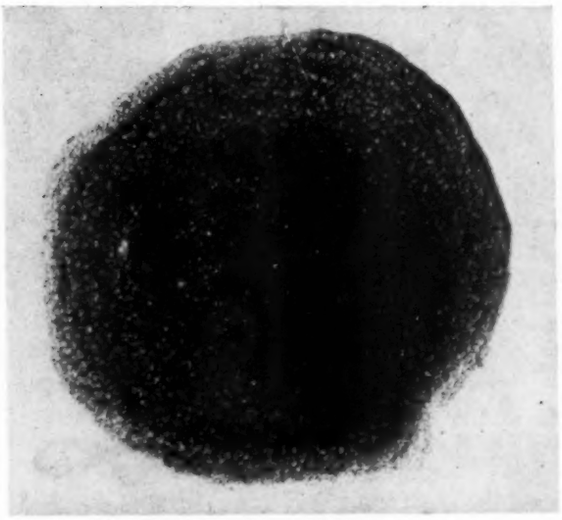


FIG. 1. Normal dried drop of blood, low power magnification. Note the compact design and a dark agglutinated nucleus, without dried lakes of plasma. × 45.

## METHODS

The technic outlined by Bolen of very lightly touching the under surface of a clean glass slide three or more times to a small drop of blood was employed throughout. Each was thoroughly allowed to dry horizontally with the glass slide righted. A blood pattern with compact design and a dark agglutinated nucleus, without dried lakes of plasma, as interpreted both macroscopically and microscopically was considered "normal." (Figs. 1 and 2.) The "early carcinoma pattern" was interpreted as lacking a central nucleus but accumulating peripheral dried lakes of plasma without red cells so that the central area was darker than the periphery. (Figs. 3 and 4.) This is the pattern of "peripheral breakdown" referred to by Bolen as characteristic of early malignancy. "The dotted curtain" or ground glass appearance of the dried blood broken down into heterogenous dots was required for a slide to be interpreted as demonstrating the "advanced carcinoma pattern." In this pattern the fibrin was broken up, there were lakes of dried plasma without red cells throughout and microscopically "three-cornered, tri-asteroid spicules" as described by Bolen were scattered throughout the dried drop of blood. (Figs. 5 and 6.)

Sedimentation rates were recorded on a few representative patients.

## RESULTS

In forty-three clinically proved cancer cases thirty-five or 81.4 per cent revealed positive slides according to the Bolen technic. (Table 1.) However, only two of these were cases of early malignancy and yet fourteen of the thirty-five slides indicated "early malignancy" and only twenty-one indicated "advanced malignancy," a percentage of 51.2 per cent correct for the diagnosis according to which Bolen interprets

* From the Departments of Surgery and Physiology, Stritch School of Medicine of Loyola University, Mercy and Cook County Hospitals, Chicago, Ill.

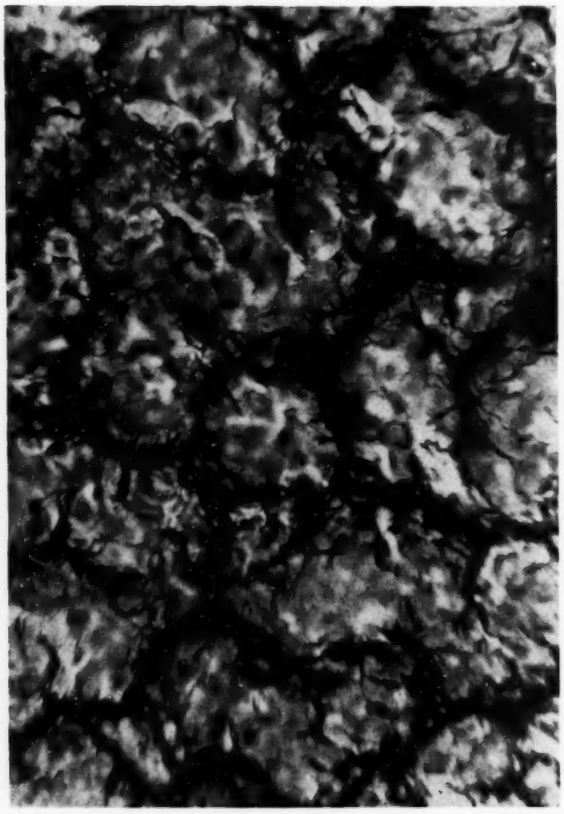


FIG. 2. Normal dried drop of blood, high power magnification. × 450.

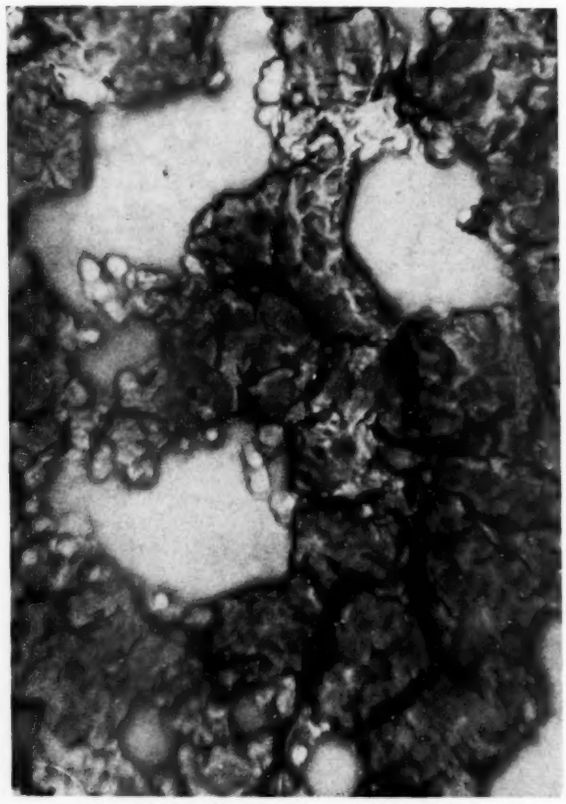


FIG. 4. "Early malignancy" pattern of dried drop of blood, high power magnification. × 450.

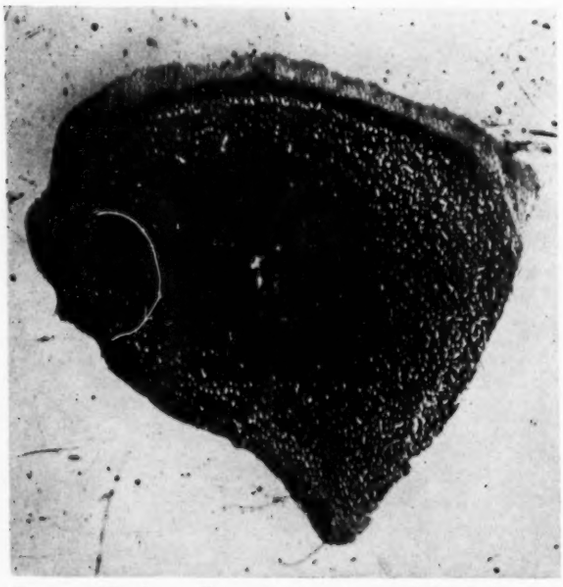


FIG. 3. "Early malignancy" pattern of dried drop of blood, low power magnification. Note the lack of a central nucleus, but accumulating peripheral dried lakes of plasma without red cells so that the central area is darker than the periphery. This is the pattern of "peripheral breakdown" referred to by Bolen as characteristic of early malignancy. × 45.

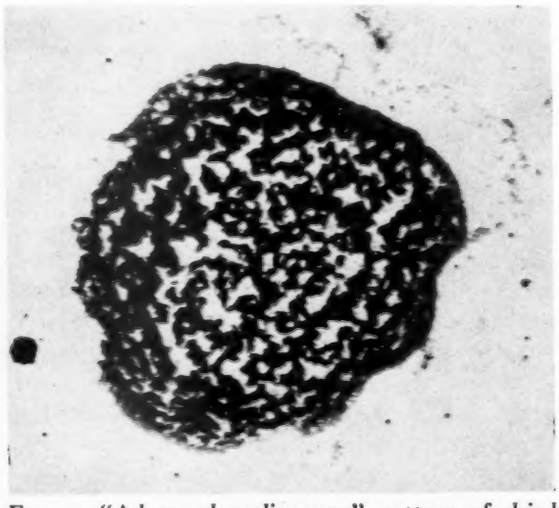


FIG. 5. "Advanced malignancy" pattern of dried drop of blood, low power magnification. Note "the dotted curtain" or ground glass appearance of the dried blood broken into heterogeneous dots. The fibrin is broken up and there are lakes of dried plasma without red cells throughout. × 45.

"early" and "late" malignancy. The early breast tumor (intraductal papillary carcinoma) did not give a positive blood pattern, and the other "early" tumor was that of melanoma, a condition well known to frequently recur fatally even though an "early" malignant tumor is apparently totally excised.

In fifty-two non-cancer cases (all of which were followed eight to twelve months to be certain that no malignancy developed in those demonstrating positive slides), twenty-nine or 55.8 per cent revealed positive slides. (Table II.) Of these, nineteen or 36.5 per cent demonstrated the "early malignancy" pattern and ten or 19.3 per cent demonstrated the "advanced malignancy" pattern. Only twenty-three or 44.2 per cent of these non-cancer patients had negative slides.

In five apparently clinically cured cancer cases (Table III), three by surgical extirpation and two by irradiation, only one or 20 per cent gave a positive slide (this case, having had a malignant thyroid adenoma removed three years before, showed an "advanced malignancy" pattern). The other four, or 80 per cent showed negative slides. Table III roughly parallels a similar one presented by Bolen.

Of the nine representative patients in which the sedimentation rates were measured (Table IV), eight that demonstrated either "early" or "advanced" malignancy had elevated sedimentation rates. The only one with a normal sedimentation rate recorded had a negative blood pattern. One patient having a negative blood pattern (a proved advanced carcinoma of the prostate) had an elevated sedimentation rate.

FIG. 6. "Advanced malignancy" pattern of dried drop of blood, high power magnification. Note the "three cornered tri-asteroid spicules" as described by Bolen scattered throughout the dried drop of blood. × 450.

## COMMENTS

The results of this clinical evaluation indicate that although the Bolen blood pattern may be positive in 80 per cent or more of clinically malignant cases it is not by any means specific enough for a routine test for malignancy, nor is it apparently sensitive enough to detect the early malignancies, as it has not been shown to be positive when the sedimentation rate is not elevated. Bolen presented thirty cases of gastrointestinal malignancy with sedimentation rates recorded, all of them definitely elevated according to his own criterion except one which was between his range of "borderline" and "elevated" for the female. Nowhere could we find evidence reported that the blood pattern test becomes positive routinely before the sedimentation rate is elevated. Bolen records the well known fact that "early cancer produces little alteration in the velocity" of blood sedimentation. (It is, of course, possible that the sedimentation rate may be retarded by cachexia in terminal malignancy, but there is seldom any doubt of the diagnosis then. However, this may explain why some of the nearly terminal malignancies did not give a positive blood pattern.)

## SUMMARY

Results are presented of gross and microscopic blood pattern studies made in 100 cancer and non-cancer patients.

The blood patterns are divided into three categories; (1) negative, (2) positive for "early malignancy," and (3) positive for "advanced" malignancy, as defined by Bolen.

Specificity of "early" and "advanced" malignancy according to the blood patterns on the slides could not be accurately correlated

TABLE I
PROVED CANCER CASES (43)

| Site | No. of Cases and Clinical Stage | | Positive Pattern | | Negative Pattern | Per cent Positive | Clinical Stage Correlation | |
|---|---|---|---|---|---|---|---|---|
| | Early | Advanced | Early | Advanced | | | Per cent Early Correct | Per cent Advanced Correct |
| Tongue | .. | 1 | 1 | .. | .. | 100 | ... | 0 |
| Larynx | .. | 2 | .. | 2 | .. | 100 | ... | 100 |
| Esophagus | .. | 2 | 2 | .. | .. | 100 | ... | 0 |
| Stomach | .. | 5 | 1 | 1 | 3 | 40 | ... | 20 |
| Pancreas | .. | 4 | 1 | 2 | 1 | 75 | ... | 50 |
| Colon | .. | 5 | 1 | 3 | 1 | 80 | ... | 60 |
| Rectum | .. | 3 | 2 | 1 | .. | 100 | ... | 33 |
| Lung | .. | 4 | 1 | 3 | .. | 100 | ... | 75 |
| Breast | 1 | 2 | .. | 2 | 1 | 67 | 0 | 100 |
| Cervix | .. | 1 | .. | 1 | .. | 100 | ... | 100 |
| Prostate | .. | 2 | 1 | .. | 1 | 50 | ... | 0 |
| Kidney | .. | 2 | 1 | 1 | .. | 100 | ... | 50 |
| Bladder | .. | 2 | .. | 2 | .. | 100 | ... | 100 |
| Generalized carcinomatosis | .. | 3 | 1 | 2 | .. | 100 | ... | 67 |
| Melanoma | 1 | .. | 1 | .. | .. | 100 | 100 | ... |
| Neurofibroma | .. | 1 | .. | .. | 1 | 0 | ... | 0 |
| Giant follicular hyperplasia | .. | 2 | 1 | 1 | .. | 100 | ... | 50 |
| Totals | 2 | 41 | 14 | 21 | 7 | 81.4 | 50 | 51.2 |

TABLE II
NON-CANCER CASES (52)

| Disease | No. of Cases | Positive Pattern | | Negative Pattern | Per cent | | |
|---|---|---|---|---|---|---|---|
| | | Early | Advanced | | Positive | Early | Advanced |
| Gastric ulcer | 6 | 2 | 1 | 3 | 50 | 33.3 | 16.7 |
| Duodenal ulcer | 2 | .. | .. | 2 | 0 | ..... | ..... |
| Benign obstruction jaundice | 3 | 1 | 2 | .. | 100 | 33.3 | 66.7 |
| Cholecystitis and cholelithiasis | 2 | 1 | .. | 1 | 50 | 50 | ..... |
| Empyema of gallbladder | 2 | 1 | 1 | .. | 100 | 50 | 50 |
| Cirrhosis of liver | 1 | .. | .. | 1 | 0 | ..... | ..... |
| Thyroid nodular goiter | 3 | 1 | 1 | 1 | 66.7 | 33.3 | 33.3 |
| Toxic goiter | 1 | .. | .. | 1 | 0 | ..... | ..... |
| Chronic cystic mastitis | 2 | 2 | .. | .. | 0 | ..... | ..... |
| Uterine fibroids | 5 | 1 | 1 | 3 | 40 | 20 | 20 |
| Chronic prostatitis | 1 | 1 | .. | .. | 100 | 100 | ..... |
| Chronic cervicitis | 1 | .. | .. | 1 | 0 | ..... | ..... |
| Ovarian cystadenomas | 1 | .. | 1 | .. | 100 | ..... | 100 |
| Pregnancy 1st trimester | 1 | .. | .. | 1 | 0 | ..... | ..... |
| Terminal pregnancy | 5 | 5 | .. | .. | 100 | 100 | ..... |
| Postpartum pregnancy 4 days | 1 | .. | .. | 1 | 0 | ..... | ..... |
| Pneumonia | 1 | 1 | .. | .. | 100 | 100 | ..... |
| Thromboangiitis obliterans | 1 | 1 | .. | .. | 100 | 100 | ..... |
| Hemangioma, thigh | 1 | 1 | .. | .. | 100 | 100 | ..... |
| Hematoma, thigh | 2 | .. | 2 | .. | 100 | ..... | 100 |
| Rheumatoid arthritis | 2 | .. | .. | 2 | 0 | ..... | ..... |
| Diabetes and arteriosclerosis | 2 | 1 | 1 | .. | 100 | 50 | 50 |
| Thrombophlebitis | 1 | .. | .. | 1 | 0 | ..... | ..... |
| Osteoporosis | 1 | .. | .. | 1 | 0 | ..... | ..... |
| Ruptured nucleus pulposus | 1 | .. | .. | 1 | 0 | ..... | ..... |
| Inguinal hernia | 1 | .. | .. | 1 | 0 | ..... | ..... |
| Neuroses | 1 | .. | .. | 1 | 0 | ..... | ..... |
| Normal student nurse (control) | 1 | .. | .. | 1 | 0 | ..... | ..... |
| Totals | 52 | 19 | 10 | 23 | 55.8 | 36.5 | 19.3 |

TABLE III
CLINICALLY APPARENTLY CURED CARCINOMA CASES (5)

| Side | No. of Cases | Treatment | | Positive Pattern | | Negative Pattern | Per cent | |
|---|---|---|---|---|---|---|---|---|
| | | Surgery | Irradiation | Early | Advanced | | Positive | Negative |
| Lip | 1 | .. | 1 | .. | .. | 1 | ... | 100 |
| Thyroid | 1 | 1 | .. | .. | 1 | .. | 100 | ... |
| Cervix | 1 | .. | 1 | .. | .. | 1 | ... | ... |
| Colon | 2 | 2 | .. | .. | .. | 2 | ... | 100 |
| Totals | 5 | 3 | 2 | 0 | 1 | 4 | 20 | 80 |

TABLE IV
BLOOD SEDIMENTATION RATES (9 CASES)

| Disease | No. of Cases | Negative Pattern | Positive Pattern | | Sedimentation Rates | |
|---|---|---|---|---|---|---|
| | | | Early | Advanced | Elevated | Normal |
| Sigmoid carcinoma | 1 | .. | .. | 1 | 1 | .. |
| Prostate carcinoma | 2 | 1 | 1 | .. | 2 | .. |
| Ovarian cystadenoma | 1 | .. | .. | 1 | 1 | .. |
| Lip carcinoma (postirradiation) | 1 | 1 | .. | .. | .. | 1 |
| Empyema gallbladder | 2 | .. | 1 | 1 | 2 | .. |
| Giant follicular hyperplasia | 2 | .. | 1 | 1 | 2 | .. |
| Totals | 9 | 2 | 3 | 4 | 8 | 1 |

with the pathologically proved carcinoma cases although 81.4 per cent of the proved cases gave a positive pattern.

A positive "malignancy" blood pattern was given in 55.8 per cent of the non-cancer cases, 19.3 per cent of these indicating "advanced malignancy." A follow-up of eight to twelve months revealed no development of malignancy in this group.

The Bolen blood pattern test cannot be verified as a good laboratory procedure for detecting early cancer from this study. However, it may be useful as a simple, modified sedimentation rate technic in following the course of carcinoma patients treated by total extirpation or irradiation as an adjunct in evaluating "clinical cures."

REFERENCES

1. BOLEN, H. L. The blood pattern as a clue to the diagnosis of malignant disease. *J. Lab. & Clin. Med.*, 27: 1522, 1942.
2. BOLEN, H. L. Diagnostic value of blood studies in malignancy of the gastrointestinal tract. *Am. J. Surg.*, 68: 316, 1944.
3. GOLDBERGER, E. Rapid bedside test for measuring the blood sedimentation rate. *New York State J. Med.*, 39: 867, 1939.
4. GIRON, M. A. Thesis—La Eritrosedimentacion en Gota Gruesa como Guia en el Diagnostico del Cancer, Guatemala, July, 1943.

# HERNIATED CERVICAL DISC

## A NEW FORM OF TRACTION THERAPY

BERNARD D. JUDOVICH, M.D.
*Philadelphia, Pennsylvania*

A HERNIATED cervical disc manifests itself clinically by pain in the shoulder girdle and upper extremity with signs and symptoms characteristic of brachial plexus neuralgia. Pain in the course of the brachial plexus may be a symptom of serious pathologic disorder. Unless a careful study has been made to localize the level and source of the pain, and until these studies have ruled out the possibility of a causative lesion, the term brachial plexus neuralgia should not be used as a diagnosis. Among the more common conditions which are local and pertain directly to irritation of the nerve components of the plexus are osteoarthritis of the cervical spine, degenerative changes of the intervertebral discs with narrowing of the intervertebral foramina, root compression by a protruding cervical disc and scalenus anticus syndrome. Neuralgia or neuritis of the brachial plexus is not uncommon as a result of diabetes, trauma, acute infection with toxic absorption, and malignant infiltration.

The causes of pain developing in the course of brachial plexus or from conditions which simulate brachial plexus pain may be grouped as follows:

1. *Local processes:* In bones, joints, ligaments, bursae, muscles and tendons due to trauma, infection, neoplasm and metabolic disturbances; bursitis, cervical rib, scalene, scapulocostal, and infraspinatus syndromes; epicondylitis, glomus tumor, muscle spasm due to early Parkinson's disease.

2. *Vascular disease:* Raynaud's, Buerger's, phlebitis, aneurysm, arteritis, scalenus anticus syndrome, costoclavicular syndrome.

3. *Peripheral nerve disease:* Neuritis, reflex dystrophies, osteoporosis, multiple and localized; neuralgia; role of focal infections and deficiency states; tumors and traumatic factors.

4. *Brachial plexus disease:* Trauma; tumors and other compressive factors; cervical rib; scalenus anticus syndrome; superior sulcus tumor.

5. *Root affections:* (a) Inflammatory lesions; lues; suppurative and non-suppurative processes; herpes zoster. (b) Compressive lesions, in the intervertebral foramina and the epidural, and subarachnoid spaces; primary and secondary tumors and lymphoblastomas; syphilis, tuberculosis, arachnoiditis, herniation of nucleus pulposus, chronic epidural infections, arthritis and trauma.

6. *Intramedullary spinal cord lesions:* Tumors, syringomyelia, and other "central" pains.

7. *Referred pain:* From the heart and great vessels; from the lungs; from the mediastinum; from the diaphragm; from the abdominal viscera (a) into the left shoulder from splenic injury, pancreatitis or pancreatic carcinoma and ruptured peptic ulcer; (b) into the right shoulder from the gallbladder and liver disease, subdiaphragmatic abscess and ruptured peptic ulcer.

8. *Psychalgia.*

The diagnostic procedures may be outlined as follows:

*History:* Duration of pain and of associated symptoms. Character of pain and aggravating and relieving factors. Distribution of pain; local, peripheral or radicular. Weight loss and other somatic factors.

*Objective examination:* Complete somatic and detailed neurologic study. (1) Range of joint motion; (2) compression and traction maneuvers of cervical spine; (3) weakness, tone, atrophy, and fibrillations; (4) reflex changes, anesthesia, tenderness; (5) skin temperature and color; (6) arterial pulsations.

*Routine studies:* Temperature range, x-ray examination of the cervical and dorsal vertebrae, the chest, the shoulder joint and scapula, urinalysis, complete blood count, blood sugar, urea nitrogen and uric acid, serologic studies and sedimentation rate.

*Special studies:* Bence-Jones, basal and metabolic studies, phosphatase studies, biopsy, sternal puncture, cultures; spinal tap for hydrodynamics and detailed study of the spinal fluid; myelogram.

*Repeated studies:* At times, repeated physical and neurologic and laboratory studies are necessary.

### DIFFERENTIAL EXAMINATION

Grossly, from the viewpoint of clinical examination, we may divide pain in the shoulder and upper extremity into two groups: (1) The shoulder joint is painful on motion, either active or passive. (2) The shoulder joint is not painful and has free range of motion in all directions.

Usually this will differentiate shoulder joint lesions from those arising from lesions in the cervical spine. Local lesions, such as tendinitis, periarthritis, arthritis and bursitis, are usually evidenced by some limitation of movement of the shoulder joint and are associated with pain and local tenderness. Pain may radiate to the lower arm and may or may not be associated with paresthesia. Tenderness in the lower referred area from a shoulder joint lesion is usually absent unless a reflex scalene syndrome develops.

If the shoulder joint is normal, the cervical spine is then examined for evidence of limited motion or "painful catch" going through the full range of motion. Pain in the cervical spine or reproduction or intensification of radiating pain induced by the aforementioned maneuvers is usually evidence that the cervical spine or its surrounding tissues are the source of pain. If the motion of the cervical spine is painful, traction and compression maneuvers are applied by the examiner.

If the examination through these procedures is negative, and there are no positive signs of nerve involvement, the supraclavicular fossa is palpated for evidence of a scalene syndrome, enlarged glands or other local lesion. If the brachial plexus and scalene muscle are not tender to pressure overlying the first rib, and there is no tenderness in the painful periphery and all signs of nerve involvement are absent, search should be made for radiation of a reflex nature, either from the skeletal structures of the shoulder girdle or from structures of the upper extremity. Pain associated with motion or position, increases the likelihood that its origin is skeletal. If the pain is not related to motion and position, and the skeletal structures appear to be negative, visceral referred pain should be suspected and possible sources should be investigated. The phrenic nerve should be eliminated as a possible source of neck, shoulder and arm pain.

### LATERALLY DISPLACED CERVICAL INTERVERTEBRAL DISC

A laterally displaced cervical disc is one of the common causes of pain in the shoulder girdle and upper extremity. Discomfort may range from mild annoyance to that of unbearable intensity. The pain may be generalized throughout the shoulder girdle and radiate to the lower arm and hand, or it may be most intense in the neck, scapular region, precordium, shoulder joint region, the upper arm, lower arm, the hand or fingers, depending upon the level of herniation and fibres irritated. The sensation of numbness and tingling may be limited to one or two fingers and at other times the whole hand may be involved. The lower medial aspect of the scapula or interscapular region may be the point of major complaint. In the extremity there may be a sensation of numbness and tingling, motor weakness, fibrillation and muscle atrophy. The grip is often poor. The history elicited may be one of repeated episodes of stiff, painful neck, trauma, or the onset may have developed without apparent cause. The pain is usually worse in the recumbent position, often awakening the patient from sleep or preventing sleep. Motion of the neck, usually hyperextension or rotation of the chin to the painful side aggravates the pain. Coughing, sneezing or straining may cause severe jolts of pain. However, these characteristic symptoms may be absent. Occasionally patients in acute distress are observed with good motion of the head and no complaint of neck pain.

### EXAMINATION

Motion of the cervical spine may be only moderately limited or it may be marked with spasticity and severe pain on motion. When limited motion is present, attempted hyperextension or rotating the chin to the painful side are usually the most painful maneuvers. Limited motion in some patients is not apparent. The pain at times is out of all proportion to the degree of mobility. Brisk percussion with a hard rubber hammer or pressure over the lower cervical spinous processes usually evokes a sharply painful response. Rarely this sign may be absent. The anterior scalene muscle is

often full and tender. Pressure upon the muscle just above the clavicle nearly always intensifies the radiating pain. The shoulder joint moves freely through a complete range of motion without pain. Atrophy of the muscles of the scapular region, the biceps, the triceps or hand may be present. Weakness of the biceps or triceps muscle may be evident. Gripping power of the hand may be diminished. The biceps reflex, C5-C6 interspace, or the triceps reflex, C6-C7 interspace, may be absent, diminished or normal. Sensory changes may be present. Excruciating pain may exist without evidence of objective motor or sensory abnormalities. Roentgen studies may or may not show narrowing of the intervertebral spaces.

### MIDLINE HERNIATED CERVICAL DISC

The great majority of herniated cervical discs are laterally displaced. Much less common is the centrally located disc which protrudes from before backward upon the anterior aspect of the spinal cord. As a result the signs and symptoms which develop in these cases may simulate those of spinal cord degenerative disease or spinal cord tumor. The clinical picture may resemble that of syringomyelia, multiple sclerosis or amyotrophic lateral sclerosis. Due to the changes which take place with a central disc it may be hazardous to apply heavy cervical traction especially in the presence of a large calcified disc.

Heavy traction in midline cervical herniated discs should be applied with caution or not at all because of possible cord damage. In one case, however, we attempted its use and obtained complete and unexpected relief of pain following a fifteen-minute treatment:

J. B., a thirty-seven year old man, complained of pain in the cervical spine, both shoulders, the right axilla and arm. "The arm goes dead and the last four fingers go to sleep." There was occasional "deadness" of the left arm. Pain was aggravated by coughing and by movement of the head and neck. Associated with this was headache which radiated from the occiput to the eyeball; duration six and a half years with recurrent attacks. The present attack was of two months' duration. The patient had worn a plaster collar for six weeks. This had been removed just prior to his initial visit on May 29, 1952, without relief of pain, and surgery had been advised. Examination revealed that pain was caused by movement of the cervical spine in all directions, including downward compression. There was moderate atrophy in the left scapular region. The biceps tendon reflexes were normal. Both triceps tendon reflexes barely responded. In the lower extremities the tendon reflexes were exaggerated. There was an abortive ankle clonus on the left with a suggestive Babinski; a positive Babinski was obtained on the right.

Test traction up to 40 pounds gave no relief and at 40 pounds the pain increased. Both anterior scalene muscles were infiltrated with procaine and traction was given at 40 pounds for fifteen minutes. There was marked immediate improvement. The patient left the office and was admitted to Graduate Hospital for studies. The next morning all neck signs had completely disappeared. He had slept well, was free of pain and was discharged from the hospital without further therapy.

### COMPRESSION AND TRACTION MANEUVERS OF THE CERVICAL SPINE

Traction and compression maneuvers of the cervical spine are of diagnostic as well as therapeutic importance. When examining a patient for a lesion in the cervical spine, especially that of a herniated cervical disc, the response of the patient to compression and traction maneuvers is of major clinical significance. If downward compression of the cervical spine causes the pain to be intensified and reproduces radiation, the cause of the pain is, in all likelihood, vertebral rather than extravertebral. One would expect that if causes of pain were in muscle or other soft tissues about the cervical spine, compressing the cervical spine would relax these tissues and ease the pain. Therefore when compression of the spine accentuates the pain, we can assume, until proved otherwise, that the pain is vertebral in origin. In the case of a herniated cervical disc the pain usually develops not only on compression of the cervical spine, but also on tilting the cervical spine to the painful side and then applying downward pressure. (Figs. 1 and 2.) On the other hand, if pain were in the extravertebral soft tissues and the painfu' structures were extended or stretched, one would expect increased pain. With a cervical disc, however, the reverse is true. Stretching or extending the neck causes immediate complete or partial

1 2

FIG. 1. Compression of the cervical spine by downward pressure upon the head.

FIG. 2. Lateral tilt of head toward the painful side with compression of cervical spine.

relief in 40 to 50 per cent of patients when sufficient force is exerted.

### HEADACHE AND OCCIPITAL PAIN

Pain in the upper cervical spine, the occipital, and the parietal and temporal regions is not rare in association with a protruding cervical disc. In some instances the pain is associated with a sense of pressure behind the eyeball. More rarely, facial pain may be present.

Two mechanisms, apparently, may be responsible for the projection of pain in these areas. One is by way of the descending or spinal root of the trigeminal nerve, which has been demonstrated to descend for several segments in the cervical cord, and the other appears clinically to be vascular in type. The surface manifestations of the latter are tenderness of the occipital and superficial temporal arteries. The common carotid artery may be tender to pressure. We have presumed the ophthalmic artery to be involved because of the associated sense of pain and pressure behind the eyeball. In the vascular type of reference firm pressure in the tender occipital zone may ease the pain in the temporal region and behind the eyeball. Rolling the tissues with deep pressure may increase the pain reference. The pattern is identical with that observed in vascular tension headaches. In some patients the history may reveal the existence of recurrent headaches for some time prior to the onset of the brachial plexus pain. Vascular headache appears to be, by far, the most common type of headache associated with a cervical disc syndrome.

If headache is associated with the chief complaint, the occiput is examined for tenderness especially at a point midway between the tip of the mastoid and the mid-cervical spine. The temporal region is examined for tenderness over the area of the superficial temporal artery. Tapping sharply over the artery may evoke a sharply painful response, whereas pressure may not. The opposite non-painful side is used for comparison. The headache in some patients is a major complaint. Relief is often obtained by infiltrating the tender occipital area with procaine.

### REFLEX DYSTROPHY

In reflex dystrophies which develop in the upper extremity the tendons frequently appear to be the structures first involved, probably because of their paucity in blood supply. In the shoulder joint region contracture develops which at first resembles a tendinitis, bursitis or frozen shoulder. In the hand the tendons and palmar fascia become involved with subsequent contracture so that the fingers cannot be fully extended. To this we should like to add that we have not infrequently observed a tendinitis about the elbow especially of the extensor tendons at their point of origin medial to the external condyle. We have noticed this phenomenon associated with a herniated cervical disc. After the neck motion has been completely restored and the shoulder girdle pain has disappeared completely, pain and paresthesia may persist from the elbow to the fingers. In the examination no tenderness is found in

the neck, shoulder or periphery, except for a point of tenderness just medial to the external condyle. Pressure and rolling of this area may reproduce the symptoms. A few cubic centimeters of 2 per cent procaine solution injected into the tender area usually causes immediate disappearance of pain and paresthesia. Previously we had labelled this condition as an extensor tendinitis and had treated it no differently. We mention these facts because of the change in our ideas concerning etiologic factors; and suggest that this condition may be a manifestation of reflex impulses similar to those involving the shoulder and hand which develops as a dystrophic aftermath of myocardial infarction.

### INTERSCAPULAR PAIN

Scapular and interscapular pain is not uncommon in a herniated cervical disc, and it is worth while to differentiate a number of conditions which, because of atypical symptoms, may cause some confusion. Pain in the interscapular region may be caused by several common conditions: (1) herniated cervical disc; (2) cervical rib and scalenus anticus syndrome; (3) intercostal neuralgia; (4) local disease; (5) atypical pain from coronary disease; and (6) visceral referred pain.

*Herniated Cervical Disc.* The most intense pain may be in the interscapular region with only minor or negligible pain in the shoulder and arm. If positive cervical traction and compression maneuvers are present, they are almost pathognomonic of this condition. In addition to this, tenderness over the lower cervical spinous processes on pressure and percussion, and radiating pain to the interscapular region by scalene compression or by rotation and extension of the cervical spine are further confirmatory signs. Roentgen studies may reveal narrowing of intervertebral spaces at levels which correspond to the clinical findings.

*Cervical Rib and Scalenus Anticus Syndrome.* Pressure upon the lower end of the anterior scalene muscle will cause intensification of pain not only in cervical rib and anterior scalene syndromes but also in herniated cervical discs. X-ray studies will eliminate or confirm a cervical rib. In a scalene syndrome diagnostic compression and traction maneuvers are negative and the cervical spine moves freely. A diagnostic infiltration of procaine in a primary scalene syndrome will cause pain to disappear completely within a three-minute period. Criteria for interpretation of this test have been previously described.[5] In the presence of a cervical spine or shoulder girdle lesion associated with a reflex scalene contracture only partial relief will be obtained, and the primary cause of the pain must be sought.

*Intercostal Neuralgia.* This condition is diagnosed by finding segmental tenderness of the sensory dermatomes which correspond to the painful interscapular levels. If there is tenderness over the spinous processes, it will shift with displacement of the skin. Paravertebral nerve block will cause the pain and tenderness to disappear within a few minutes, in a diagnostic as well as a therapeutic procedure.

*Local Disease.* In local conditions affecting the interscapular region tenderness is localized to the painful area only. Careful search is made for palpable tissue changes and roentgen studies should include the dorsal spine, scapula and chest. Visceral referred pain is the most likely condition to be confused with local disease. Anesthesia of a painful area followed by relief of pain may be misleading. Metastatic malignancy, not immediately apparent in x-rays, may be revealed in repeated studies.

*Atypical Coronary Pain.* In some instances pain having its origin from the heart will have its greatest intensity in the interscapular region. There may or may not be spot tenderness to pressure or pinch. Tenderness is usually absent. All attempts to reproduce the pain by movement of skeletal structures are negative. A history usually reveals that the pain is brought on by effort. Symptoms can be produced by exercise and relieved by nitroglycerine. Atypical coronary pain can at times be difficult to diagnose because of completely negative electrocardiographic studies and the atypical locations of the pain. In one particular instance a patient who had been thoroughly studied from a cardiologic viewpoint with negative findings had a scalenotomy and a brachial plexus exploration. Subsequent events proved the condition to be cardiac in origin. In patients with atypical pain the most important clue is in the history.

*Visceral Referred Pain.* Interscapular pain due to visceral disease has been most commonly, in our experience, due to duodenal ulcer. The interesting feature in some of the patients we have seen has been constant pain and total absence of gastrointestinal symptoms.

In one case there was a constant bilateral radiation of pain of seven months' duration along the ribs to the epigastrium, without relief. No tenderness of any kind was found in association with the pain. In another case the pain was constant with acute exacerbations awakening the patient from sleep. Pain subsided immediately when the patient was placed on an ulcer diet with acid adsorbents. This particular patient had tenderness of D6 and D7 spinous processes to pressure and percussion. In another instance in which signs of tenderness were completely absent, a gastrointestinal study was suggested to the patient. The studies were negative. Three months later, however, the patient collapsed from hemorrhage and was told that he had an occult ulcer. In still another case a medical student who complained of interscapular pain presented no symptoms to suggest any form of musculoskeletal pain. The patient was informed that no signs of intercostal neuralgia were present but that a nerve block would be done to note the effect. We did, however, inquire as to whether or not upper gastrointestinal study was done. Nerve block had no effect upon the pain. The patient was due back in a week but did not appear because he suffered a sudden hemorrhage due to duodenal ulcer.

These cases are all mentioned because each has its lesson. When patients present themselves with interscapular pain with either *absence of tenderness* or spot tenderness at the level of D6 D7, either over the spinous processes or in the paravertebral region, duodenal ulcer should be suspected regardless of the relationship of pain to meals or the constancy of the pain. When there is total absence of tenderness, a visceral lesion should be the first consideration. One of the most misleading features has been severe *constant pain* without visceral symptoms. These patients should be told of the possibilities and, in addition to routine studies, the gastrointestinal tract should be investigated.

### TEST TRACTION

In a series of over sixty patients who presented signs and symptoms of a laterally displaced cervical disc, test traction was employed. This consisted of applying a head halter and applying increasing force, 5 pounds at a time, up to 45 or 50 pounds. When sufficient force was exerted, almost half of the patients obtained immediate complete or partial relief for the duration of the pull. This force varied, in our experience, from 25 to 50 pounds. In some instances pain was aggravated with pull up to 25 pounds and was relieved, but not completely, over 35 pounds. In other instances the pain was aggravated by pull up to 35 or 40 pounds and not relieved by added force. Some of patients who obtained immediate complete relief had been hospitalized and treated with 5 to 10 pounds of traction without benefit.

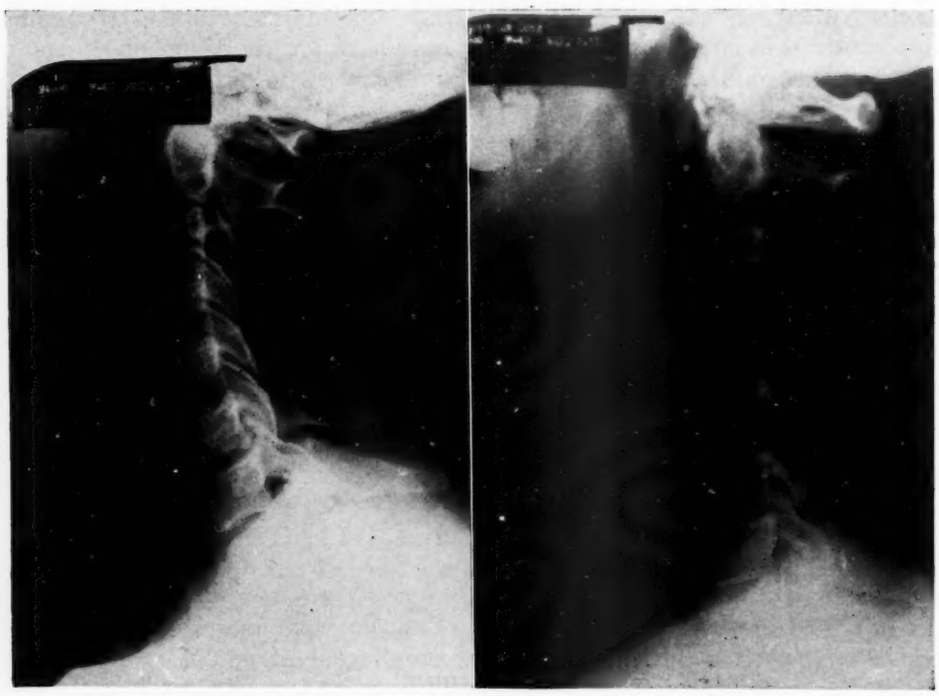
From the aforementioned there appears to be a wide variation in the initial response to traction, as well as the necessary force to provide relief of pain. The force that is adequate for one patient is not always suitable for another. For one it may be just a few pounds, for another 50 pounds. By the scale-testing method the necessary amount of traction may often be determined prior to therapy. Although concrete proof is lacking, it is most likely that the variations in pain relation occur because of differences in the pressure, location and size of the extruded mass in relation to the nerve root, or other pain sensitive structures. In our experience 25 to 30 pounds has been the minimum level of adequate traction in the average case of intractable pain due to herniated cervical disc. This figure was selected because it was the approximate minimum at which most of the patients with intractable pain obtained complete momentary relief by traction.

### ROENTGEN STUDIES

In an effort to correlate the clinical findings with possible changes in the cervical spine a number of patients were x-rayed during traction.

X-ray exposures of the neck in the lateral projection were made on seven consecutive patients, with and without traction.* Position of the patient, the tube distance and exposure factors were constant while continuous traction of 5, 10, 15, 20, 25, 35 and 45 pounds were applied and successive exposures made. In six of the seven patients the earliest measurable change was noted when 25 pounds of traction was applied. Measurements were made from the inferior surface of C2 to the upper surface of C7.

*Courtesy of Dr. Arthur Finkelstein, Director, Radiology Department, Graduate Hospital, Philadelphia, Pa.



3 4

FIG. 3. X-ray of the cervical spine prior to traction.

FIG. 4. X-ray of the cervical spine of the same patient with 45 pounds of traction. In this particular case a 14 mm. stretch was observed. The widening of the intervertebral spaces took place beginning at approximately 25 pounds.

When 45 pounds of weight was applied, a stretch of the cervical spine was obtained with a maximum of 14 mm. and a minimum of 3 mm. An average of approximately 5 mm. of separation occurred in the majority of cases. In six of the seven patients a small but definitely perceptible widening of the apophyseal joint was noted. While this was definite, the degree of separation was difficult to measure accurately and averaged approximately 2 to 3 mm. Attempts to evaluate the separation in the oblique projections were unsuccessful because of the changes in position resulting from increased traction. The curve of the cervical spine appeared to straighten when approximately 20 to 25 pounds of traction was applied. While the impression appears to be that it straightens at this weight, accurate objective measurements were unobtainable because of the variations in the degree of curvature that existed in the individual patients.

Although these observations are not necessarily conclusive, they do show that in those patients in whom widening of the interspaces could be demonstrated, it occurred at or above 25 pounds in the average intractable case and that this force happens to coincide with the force necessary to produce clinical relief in many of the cases of this severity. It demonstrates also that it is possible to measurably widen the intervertebral spaces in most patients with a force which can be tolerated. (Figs. 3 and 4.)

In the past it had been our practice to apply traction by pulling until the scale registered 25 to 45 pounds and tying the rope in position to maintain this pull, then waiting until the patient asked to be released. Most patients could not tolerate the traction more than a few moments when applied in this manner. However, the patients were able to take greater traction force when it was applied intermittently. Doing this manually required the presence of a technical assistant and was impractical from the viewpoint of the time element and the effort required.

Most patients cannot tolerate head halter traction with constant weight of 8 pounds or more because of the discomfort in the jaw, teeth and temporomandibular joint. On the other hand, since many intractably painful cases will obtain rapid relief when 25 to 50

pounds is employed, our problem was to find a means of administering this force without causing acute discomfort.

A motor driven mechanism was devised which allows patients to take heavy traction load for longer periods of time without the distress which would normally accompany the amount of force used. (Fig. 5.)

The apparatus that was developed for this purpose is of two designs. One is a chair with an overhead channel, with the necessary machinery installed under the seat. The degree of pull is governed by adjustment on a cam arm and can be read on a scale. A cable with pulleys and head halter provides the traction gear. This apparatus is used for ambulatory patients as an office procedure. Another model is used for bed traction. This consists of a box containing the same apparatus as the chair except that bed pulleys replace the overhead channel. This apparatus has been applied in both cervical and pelvic traction.

Intermittent traction forces expressed in equivalents of constant traction for this particular mechanism are as follows:

| Intermittent Traction | Constant Traction Equivalent |
|---|---|
| 30 pounds..... | 28½ pounds 58.3% of operating time |
| 35 pounds..... | 32½ pounds 64% of operating time |
| 40 pounds..... | 36 pounds 69% of operating time |
| 45 pounds..... | 40 pounds 72% of operating time |
| 50 pounds..... | 43½ pounds 75% of operating time |

These equivalents are based upon 25 pounds as minimum adequate traction and do not include the benefit derived from force below 25 pounds. At any given traction force there is full constant traction for 50 per cent of the operating time. This is due to the fact that the machine is designed so that at the peak of traction there is a hesitation for half the period of the cycle.

In adjusting the head halter the chin piece is centered and held in position by the patient. The occipital strap is then placed low so that it will pull up against the occiput. While held in this position the side straps are made snug. If they are made too loose, the occiput strap will slip upward and cause traction force to be centered upon the lower jaw instead of the occiput.

If, during the traction, too much pull is centered on the jaw, leaning backward in the chair will cause more pull to be placed upon the occiput. In the bed traction apparatus, raising the pulley will produce the same effect. With pull more predominant on the chin the effect of traction is slightly to extend the cervical spine. When the traction is mainly from the occiput, slight flexion of the cervical spine takes place and this is followed by extension. Always try to have the traction force greatest at the occiput. It not only causes less pain from the traction force, but also prevents the chin and temporomandibular joint from taking the burden of the force.

FIG. 5. Motorized intermittent traction apparatus devised for treatment of herniated cervical discs, osteoarthritis of the cervical spine and other conditions in which traction is indicated. Because of the intermittent force much greater traction load can be administered for prolonged periods of time without the discomfort associated with this force if applied as a constant pull. Relief of pain is rapid as compared with conventional methods.

Pulley wires, either in the sitting or supine position, should always exert force in a plane which is centered and aligned with the long axis or saggital plane of the vertebral column. After the machine is set up, arrangement of pillows and centering the patient will accomplish this purpose.

No form of traction is comfortable. Individual tolerance should be the guide for the force applied. At the present time, as an office procedure, we are using 35 to 45 pounds for one-hour periods. Most patients tolerate this

amount without marked discomfort. Some patients are able to take 50 pounds without complaint. Most of the pain associated with heavy traction can be eliminated by having the patient bite upon a boxer's rubber mouth guard or by placing a hard, flat object wrapped in gauze between the molars in order to relieve pressure upon the temporomandibular joint. Some patients can take 50 to 60 pounds without protection of any kind. Others are sensitive at 30 and 40 pounds. The patients who experienced pain on initial test traction usually obtained relief, the peak traction pain gradually subsided as the machine continued to operate.

Our office routine may be summarized as follows: (1) Daily traction for one-hour periods until pain subsides; then three times a week or less, according to the degree of pain. (2) Traction therapy is preceded by 2 cc. of 2 per cent procaine infiltration of the anterior scalene muscle on the painful side, not oftener than every third day. (3) Leather support collar when indicated. (4) If the patient does not respond to ambulant therapy, continuous intermittent traction is applied as a hospital procedure. (5) Myelogram and laminectomy for intractable pain or signs of cord compression. (6) Heavy traction is to be given with caution, or not at all, to patients with signs of a midline lesion or cord involvement.

In hospitalized patients we have used force ranging from 25 to 40 pounds with the machine operating most of the day and night. The patient soon learns to stay within the limit of tolerance by sliding his body up slightly to ease the pull or sliding downward to increase the pull. Fifteen-minute rest periods were given every one or two hours. Sometimes no rest period was taken for three or four hours. When indicated, the anterior scalene muscle was infiltrated with 1½ cc. of 2 per cent procaine solution.

One of our patients (C. M.) treated at the Graduate Hospital had pain of such severity that he did not sleep for three nights. Head halter traction was applied for three days, using 10 pounds of constant weight. Little relief was obtained; the patient was still unable to obtain a night's rest. On the seventh night intermittent traction was applied with the peak pull set at 28 pounds. Seconal, 3 gr., was administered, the same dose having been given on preceding nights. Within one hour the patient fell asleep for several hours. Relief of pain was marked and sleep periods increased on successive nights. The patient was discharged in several days, quite comfortable. A follow-up three months later disclosed that the patient was free of pain and back to work.

F. K., a forty-three year old man, complained of pain in back of the neck radiating to both arms and right shoulder. The patient was previously admitted to a hospital for traction therapy for a period of ten days. Six pounds of traction was applied with little relief. Pain was more intense in the prone position. The last attack began eight months ago and the patient has had very little relief since. Motion of the head and neck or straining at stool aggravated the pain. For awhile the patient had bed traction at home and the pain subsided but has gotten progressively worse in the last two months; the patient is up most of the night. Sometimes his whole hand tingles and feels numb. X-ray showed a degenerative osteoarthritis over the 5th and 6th vertebral bodies with narrowing of C5 and C6 intervertebral space. Reflexes were normal. Pressure and percussion over C6 spinous process was painful. Downward compression of the head and neck brought on no discomfort. Lateral tilting caused no pain. Test traction had no effect until 40 or 45 pounds were reached. This caused a twinge of pain in the right shoulder. After ten minutes of intermittent traction the pain eased. The scalene muscle was infiltrated. After four treatments marked relief was obtained.

J. V., a thirty-six year old woman complained of pain in the neck radiating to the shoulder, with burning sensation in the palm of the hand. She experienced a loss of gripping power for the last seven years, off and on. The present attack was of ten days' duration, with extremely severe pain. The pain seemed to have its origin in the lower cervical spine. There was pain on rotating the chin to the right, pain on hyperextension of the cervical spine, pain on tilting the head and on compressing the spine by downward pressure on the head. The tendon reflexes were normal. C6 and C7 spinous processes were tender to percussion. X-ray revealed a narrowing of the interspace between C6 and C7. The patient was treated from October 11th to November 16, 1951, with almost complete relief from pain. Complete relief of the burning sensation and pain was obtained when 30 to 35 pounds of traction was applied. The right scalene muscle was tender.

Probable diagnosis was herniated cervical disc with a reflex scalene contracture. Therapy was administered consisting of scalene infiltration and intermittent cervical traction at 50 pounds for half-hour sessions. A follow-up four months later revealed no recurrence of pain.

J. Y., a forty-eight year old man, complained of pain in back of the neck and left shoulder with radiation to the lower arm, and numbness of the left index finger. Duration of the pain was five to six months. Otherwise, the patient felt well. Examination revealed severe pain radiating on downward compression or hyperextension of the cervical spine; left triceps reflex absent; motion of the shoulder joint normal on abduction without pain and some slight limitation of rotation with arm behind back. X-rays revealed a mild spurring between C5 and C6. Examination of the left shoulder showed marked soft tissue calcification lateral to the humeral head, but otherwise the bones and joint space of left shoulder were normal. Test-traction relieved some of the pain and tingling. There was an infiltration of the anterior scalene muscles. The patient was discharged after four treatments, with almost complete relief. In this particular instance the calcified tendon in the left shoulder appeared to play no part in the painful syndrome.

H. R., a forty-two year old man, complained of pain over the entire left scapular region, shoulder and lower arm, off and on for fifteen years, with occasional radiation to the left chest. The pain was worse on arising and diminished with continued activity. It was worse when he sat or lay down. Flexion of the cervical spine caused radiating pain to the left shoulder blade. Downward compression caused no reference of pain to the arm. Examination revealed normal reflexes. Hyperextension of the cervical spine caused no discomfort. Compression of the left scalene muscle caused pain, but the right scalene did not. Test traction at the time of the initial treatment caused an increase of pain with 45 pounds of traction. As the apparatus moved to the peak pull the pain was eased. Treatment for a period of ten days with traction of one hour a day produced marked relief. The patient then had treatments once a week for two months. Six months later there was a mild recurrence but this was relieved by four additional treatments. X-rays of the chest, cervical and dorsal spine were negative.

E. R., a thirty-three year old man, complained of pain in the left shoulder with radiation to the wrist. Onset on February 28, 1952, was very severe. Relief of pain was obtained only by lying flat in bed. Pain radiated to the wrist, and there was numbness of the thumb and forefinger, sometimes all the fingers. Extension of the cervical spine caused radiation of pain. Reflexes were normal. Compression of the cervical spine caused pain to radiate to the arm and shoulder; tender C6 spinous process to percussion. X-ray revealed a slight narrowing of the interspace of bodies C5 and C6 associated with hypertrophic spurs arising from the anterior contiguous margins of the same vertebral bodies. There was a loss of normal lordotic curve with limited extension. Traction gave immediate relief. Treatment consisted of scalene infiltration with daily traction for ten days for one hour's duration. Treatments were then given four days apart. Patient was discharged free of pain.

M. O., a thirty-two year old woman, complained of neck pain for the past eight years off and on. The patient was first seen on April 27, 1950. For the past several months pain had been more noticeable and for the past three weeks had been very severe and almost constant, with some tingling of the hands. The patient was awakened by pain which she thinks was produced by motion of the head and neck during sleep. In the past few months heavy lifting and straining appear to have precipitated this severe attack. Radiating pain was induced by hyperextension of cervical spine, affecting the left shoulder and arm. There was tenderness to percussion over C5 and C6 spinous process. The reflexes were normal. Traction of 50 pounds caused relief from pain. At the end of one hour of traction pain completely disappeared and did not recur. This is one of two instances in our series in which the patient was completely relieved by a single treatment of traction therapy. There has been no recurrence in a year and a half. X-rays of cervical spine proved to be normal.

H. H., a sixty-seven year old man, complained of pain in the neck and right shoulder with radiation into the right arm; numbness and tingling of the fingers; duration two weeks. Onset followed after hammering holes into granite with a 2-pound hammer. Heat treatments and manipulation prior to his initial visit were of no benefit. The thumb was especially numb as compared to the rest of the

hand. Past history revealed an attack of "stiff neck" two months previously. Pain was extremely severe. The patient had not slept for the past two weeks. Examination showed that extension of the cervical spine was limited and caused radiation of pain. Rotation of the chin toward the right shoulder was painful and limited. Rotation to the left was normal. There was tenderness to pressure and percussion over C6 spinous process. The right biceps reflex was absent. The right anterior scalene muscle was full and tender to pressure causing radiation of pain. Tilting the head forward was painful and downward compression of the cervical spine caused radiation of pain. Test traction of 50 pounds gave no relief; pain increased at 40 pounds. Intermittent traction was applied and after the machine ran for six or seven minutes, the pain at the peak pull decreased. The right anterior scalene muscle was infiltrated with 1½ cc. of 2 per cent procaine. The patient was given traction for one hour. The next day he felt much better and had some sleep during the night. Treatment was repeated on February 6th and 16th. On the latter visit the patient was so much improved that he was discharged free of pain. No recurrence has been reported. X-rays revealed narrowing of C6 and C7 interspace with marked hypertrophic changes in the vertebral bodies only at this level.

### PRECAUTIONARY MEASURES IN TRACTION

(1) Patients who present findings of a midline disc should be subjected to traction very cautiously or not at all because of the possibility of cord damage. This applies especially to strong traction force. (2) Traction is to be applied with caution in marked hypertension. During the pull of heavy traction the side straps of the halter compress the jugular veins. (3) Acute torticollis or myositis of the neck muscles will have increased pain on traction without benefit. (4) Malignancy or other serious pathologic disorder is a contraindication to traction. Roentgen studies of the cervical spine, shoulder girdle and chest should be routine, preferably on the initial visit. Heavy traction in the presence of a metastatic lesion may cause severe damage. Patients who receive periods of traction and show no improvement should have x-rays repeated. Metastatic or other lesions sometimes are not evident in the initial x-rays and may appear in subsequent studies.

### SUMMARY

1. Differential diagnosis and clinical examination in brachial plexus pain have been discussed. Compression and traction maneuvers are stressed as valuable diagnostic signs in lesions of the cervical spine, particularly in herniated cervical discs.

2. Clinical studies indicate that in the average intractable case the cervical spine should be stretched by force ranging from 25 to 45 pounds. Almost half the patients in a series of sixty cases experienced partial or complete momentary relief when this force was applied.

3. Roentgen studies reveal that in the average patient the intervertebral spaces of the cervical spine begin to show measurable widening with traction force ranging from 25 to 50 pounds.

4. The necessary force to relieve pain cannot be tolerated by the average patient when it is administered as a constant pull. If administered intermittently, adequate and much greater traction load can be tolerated without the discomfort which would normally accompany such force.

5. A new method of motorized intermittent traction is presented. The clinical results of intermittent traction, because of adequate force, have been excellent as compared to conventional traction methods.

### REFERENCES

1. Spurling, R. G. and Scoville, W. B. Lateral rupture of the cervical intervertebral discs, a common cause of shoulder and arm pain. *Surg., Gynec. & Obst.*, 78: 350–370, 1944.
2. Adson, W. A. and Coffey, J. R. Cervical rib. *Ann. Surg.*, 85: 839, 1927.
3. Nachlas, I. W. Scalenus anticus syndrome or cervical foraminal compression. *South. M. J.*, 35: 663, 1942.
4. Raney, A. A. and Raney, R. B. Headache: A common symptom of cervical disc lesions. *Arch. Neurol. & Psychiat.*, 59: 603–621, May 1948.
5. Judovich, B. and Bates, W. Pain Syndromes, 4th ed. F. A. Davis Co. In Press.
6. Hanflig, S. S. Pain of the shoulder girdle, arm and precordium due to foraminal compression of nerve roots. *Arch. Surg.*, 46: 652–663, 1943.

# POSTOPERATIVE ANALYSIS OF 366 CONSECUTIVE CASES OF HERNIATED LUMBAR DISCS*

PAUL ROSS, M.D. AND FRANKLIN JELSMA, M.D.
*Louisville, Kentucky*

THIS report represents an analysis of 366 consecutive patients operated upon for a herniated disc from November, 1944 to July, 1950.[1] These patients were selected from the private practice of the senior author. All operative procedures were performed by the senior author with the exception of orthopedic procedures. The patients in this series represent a cross section of occupations in our part of the country.

The diagnosis of herniated disc is discussed at length in many excellent texts and papers.[2,3] There are certain points in the diagnosis and management of patients suspected of having herniated discs that should be emphasized. We see many patients each year with low back and leg pain. Approximately 50 per cent of these cases are regarded as probable herniated discs. In our experience of those diagnosed as probable herniated discs, 20 per cent eventually came to surgery.

There is a history of trauma such as lifting, falling, twisting or direct injuries to the back in 70 per cent of these cases. There are a certain number of cases in which no etiologic factor can be determined. Many times the patient will give a history of recurrent attacks of low back pain without any sciatic radiation. Later root pain develops with or without history of injury. It is probable that prior to the sciatic pain there is partial protrusion through the annulus with stretching and pressure upon the posterior longitudinal ligament producing pain. Both of these structures are supplied with sensory nerve fibers.[4] The aggravation of pain with coughing, sneezing and bending is a frequent complaint supplied by the patient without direct questioning by the examiner. As a rule, weakness is not a subjective complaint. One should question the patient about bladder symptoms. This is important in evaluating lesions associated with the conus medullaris or cauda equina. There may be a complaint of subjective sensory loss. The patient may describe this as a dead feeling in one of the toes or the side of the leg, depending upon which nerve root is involved. The pain may be so severe as to obscure or minimize any sensory loss recognizable by the patient.

Any recent infections or infections concurrent with the onset of the patient's difficulty should be evaluated. Also, one should question the patient about toxic agents or metabolic diseases capable of producing mononeuritis.

Neurologic examination is of utmost importance. However, it is never complete without a general physical examination. This should include a recent x-ray of the chest in all cases.

The patient with a herniated disc will usually have a positive Lasègue's sign. The degree of discomfort produced by this test is dependent upon the size and location of the herniated disc. The paravertebral muscles will be rigid with ironing out of the normal lumbar lordosis. Often there is pain or tenderness to pressure at the multifidus triangle. This is due to undue stress and strain on the origin of the multifidus and sacrospinalis muscles. Fibrositis may develop at this site and continue to be a source of discomfort for a short period of time postoperatively. The patient may complain of an aching sensation between the shoulder blades. Secondary spasm of the muscles in this region is responsible for this discomfort. There is often a list of the spine away from the side of the lesion if the disc is lateral to the nerve root, and toward the side of the lesion if the disc is mesial to the nerve root. Flexion of the back is usually limited. As a rule, hyperextension does not produce much discomfort. The ankle jerk on the affected side is diminished in about 50 per cent of the lesions located at the lumbosacral joint. Decrease in the knee jerk is found with lesions located at L4 or higher in 18 to 20 per cent of cases. Motor weakness usually involves dorsiflexion of the foot and toes or the evertors of the foot. It is essential that muscle strength in the

* From the Department of Surgery, University of Louisville School of Medicine and St. Joseph Infirmary, Louisville, Ky.

lower extremities be tested and recorded preoperatively. Aside from the medicolegal standpoint, these observations are necessary for an adequate postoperative evaluation of the patient. Also, the occasional herniated disc that produces subacute progressive paraplegia and constitutes an emergency is best observed and evaluated by frequent muscle-testing examinations. This statement does not include those cases in which there is acute complete extrusion of the intervertebral disc substance following an injury that produces acute paraplegia.

The sensory findings may vary from hyperesthesia to anesthesia. These findings depend on the duration of the lesion and the amount of damage to the nerve root involved. The value of the sensory examination depends on the persistence and experience of the examiner.[5] This is particularly true in tumors of the conus medullaris and cauda equina whose only findings may be a sensory deficit in the saddle area. One of the most useful tests in the clinical examination is pressure lateral to the posterior spinous process at the level of the lesion with the examiner's thumb. This will reproduce or intensify the pain. Occasionally in a large muscular individual rigidity of the paravertebral muscles will be such that one is unable to produce root pain by pressure at this site.

X-ray examination of the lumbar spine is most helpful in ruling out conditions such as spondylolisthesis, arthritis, fractures, tumors that produce bony erosion or destruction, spina bifida occulta and other developmental anomalies. Any one of these conditions may be present in addition to a herniated disc. In patients who are known to have malignant tumors we believe that any involvement of the nervous system is due to metastasis until proven otherwise. More extensive and repeated study of the skeletal system is indicated. Narrowing of an interspace is not diagnostic of a herniated disc. However, one finds interspaces narrowed posteriorly with normal spacing anteriorly in many cases of herniated discs. This is considered to be more significant in lesions between L4 and L5 or higher.

We use myelography only in those cases in which a tumor is suspected. We think that the diagnosis of herniated disc should be made clinically. We realize that tumors of the cauda equina and conus medullaris may simulate herniated discs.[6] There were twenty-two cases of cord tumor in the lower thoracic and lumbar region during this time with symptoms involving the lower extremities. To date we have been able to make the diagnosis preoperatively with the exception of one case of carcinoma of the prostate with metastasis, which will be discussed later. In our opinion routine myelography is unnecessary. The occasional untoward reaction following myelography and the added cost to the patient make the procedure undesirable if it can be avoided.[7]

There were 228 males and 138 female patients in this series. The average age of these patients was 39.3 years. The youngest patient was fifteen years of age and the oldest seventy.

*Operative Findings.* The side affected was about evenly divided. This is true in most reports. There were 227 discs at L5, 104 at L4 and one at L3. (Recently there have been three operations at L3 in one month.) Multiple discs were found in eighteen cases, of which seventeen involved L4 and L5. One patient had herniated discs at L3, L4 and L5. Four of the herniated discs were midline. Two patients had bilateral discs at the same level. There were two negative explorations.

A group of patients that present a special problem are those with a migratory disc. There were five patients in this group who had a definite loose piece of cartilage impinging on a nerve root at a level other than the site of the original herniated disc. It is our opinion that this is a cause of continued sciatic pain postoperatively in some instances.

This was demonstrated very emphatically in one of these cases. This patient had typical low back pain and sciatic pain left, with a history of recurrent attacks prior to the last attack, which was incapacitating. Physical findings were consistent with a herniated disc located at L5. The patient was taken to surgery and a herniated disc was found between L5 and S1 compressing the nerve root of S1. After removal of the disc at L5 the fourth interspace was exposed. The nerve root L5 was under tension and on further exploration a loose piece of cartilage was located beneath this nerve root. This cartilage was free of any connection with either intervertebral disc. The cartilage was removed and measured 1 by 2 cm. The disc at L4 was thoroughly explored and no evidence of herniation, old or recent, was found. This case is similar to the four other migratory discs in this series.

In view of these findings we think it is essential that both L4 and L5 interspaces be explored.

This is particularly true if the disc has broken through the posterior longitudinal ligament. Had the disc been removed only at the site of the herniation, it would seem likely that there would be five additional poor results to report.

The fact that multiple discs were found in eighteen of these patients is another reason for advocating exploration of both L4 and L5. We do not explore L3 unless there is some clinical finding that points to a disc at that level.

The two patients who had bilateral discs at the same level had an initial episode of sciatic pain on one side and later had sciatic pain on the opposite side. At the time of operation both patients were having bilateral pain and it was thought advisable to explore both right and left sides. A protrusion was found on both the right and left side. The protrusions were lateral and in no way connected. In one patient the bilateral protrusion was at L4 and in the other at L5. Any patient with bilateral symptoms should be explored on both sides.

There were two patients in whom no organic reason for pain could be found at operation. In both of these patients L4 and L5 were explored but no herniated disc was found. In each instance the nerve roots were uncapped. The result in both of these patients was good. They were both free of pain and able to resume their original occupation. One was followed up for two years and the other for three, with no complaints when last seen.

There were five patients who had a pain-producing lesion other than a herniated disc.

There were two cases in this group in which the only explanation for root pain was enlarged veins surrounding the nerve roots. We realize that often one sees engorged and dilated venous channels surrounding a nerve root at the site of a herniated disc. Both L4 and L5 were explored on these patients and no herniated disc was found. The enlarged veins were desiccated and removed. Also, the nerve roots were uncapped laterally. Both patients were relieved of their pain and able to return to their previous work. One patient was followed up for six years and the other for five.

One patient who had inflammatory adhesions producing his symptoms had a history of recurrent attacks of low back pain and right sciatic pain extending over a period of ten years. The patient was seen in an acute attack. Neurologic examination revealed decreased knee jerk and ankle jerk right, positive Lasègue's sign right and decreased sensation on the lateral aspect of the right calf. The laboratory findings were within normal limits. At operation the epidural adipose tissue was firm and quite resistant. The nerve roots were fixed in this adipose tissue. The nerve roots at L3, L4 and L5 were exposed and dissected free. There was no evidence of a herniated disc at any of these interspaces. This patient made an uneventful recovery and has been free of pain since operation, a period of five years.

Another patient had a typical history and clinical findings that would indicate a herniated disc at L5 left. The patient was disabled and had been bedfast eight weeks. On x-ray this man had spina bifida occulta. We realize that spina bifida occulta in itself sometimes produces pain. This has been discussed at some length in another paper and will not be dealt with here.[8] On exploration the curved rudimentary lamina on the left was found to be pressing directly on nerve root S1. A hemilaminectomy was performed in order to free the nerve root. The disc spaces at L4 and L5 were both explored and no evidence of a herniated disc was found. This patient was followed up for three and a half years. He has been free of pain and was able to resume his former occupation without difficulty. In talking with this patient after surgery we were unable to obtain any history of direct trauma to the lumbar region. We are unable to explain why this man should have had an acute onset of pain.

The last patient in this group presents an unfortunate situation. The patient's complaints on admission were low back pain and bilateral sciatic pain. On examination this man had bilateral sciatic pain and absent ankle jerks. A rectal examination was done and a slightly enlarged prostate palpated. A genitourinary consultant saw this patient and reported that the prostate showed no abnormality. X-rays of the lumbar spine and pelvis were negative for any bony abnormalities. In view of these findings we made the diagnosis of a midline herniated disc. The patient was taken to surgery and L4 and L5 were explored bilaterally. There was no evidence of a herniated disc at either interspace. This man was discharged from the hospital at the end of two weeks only to return to the hospital in two months. The original complaints of low back pain and bilateral sciatic pain were still present, only more severe. A rectal examination was again done

and it was thought that the prostate was larger than at the time of the first examination. X-rays of the spine and pelvis at this time revealed a destructive lesion in the sacrum suggesting a metastatic lesion. A genitourinary consultant was again asked to see this patient.

TABLE 1
RESULTS

| | No. of Cases | Per cent |
|---|---|---|
| Good | 301 | 82.0 |
| Fair | 55 | 15.2 |
| Poor | 8 | 2.4 |
| Mortality | 1 | 0.26 |

On examining the patient at this time the consultant thought that there was definitely a malignancy involving the prostate gland. This case was classified as a poor result and is included in the nine poor results. It emphasizes the need of repeated x-ray examination of the skeletal system in patients suspected or known to have malignancy.

*Results.* The results in this series are found in Table 1. We considered that a patient had a good result if he could resume the work he had done prior to surgery without difficulty. Some of these patients occasionally complained of a tight feeling or soreness in the back but this was not incapacitating in any way. Those patients who had occasional episodes of low back pain and sciatic neuritis were considered as having fair results. These patients were not incapacitated for work but were uncomfortable at times. Any patient who thought he was worse or no better after surgery was regarded as having a poor result. All patients were seen and examined personally in evaluating a result.

The average follow-up time of this group of cases is twenty-four months. Routine follow-up examinations are made at intervals of six weeks, and three, six, twelve, eighteen and twenty-four months. If the patient is free of symptoms at the twenty-four-month follow-up, he is discharged; otherwise, he is asked to return. We do not advise a patient to return to work before six weeks postoperatively. At this time the patient is examined and advised as to type and amount of work that would be best for him. Usually the patient is allowed to return to light work at the end of six weeks and heavy work during the three to six-month period. There is no way of stating a definite time after which all patients may return to work.

Those patients who continue to have low back pain and sciatic pain after surgery present the problem of whether or not they should undergo another operation. Some advocate reoperation within seven to fourteen days. Usually a nerve root that has been compressed will necessarily be sensitive and painful for a time after the pressure is relieved. Irritation of the nerve root secondary to retraction and manipulation at the time of surgery produces some postoperative pain. If a thorough search has been made for a disc at L4 and L5 at the time of surgery and due consideration has been given to other factors that may cause pain, we do not think that reoperation should be attempted before a period of two to three months has elapsed, during which time further evaluation of pain and focal signs is made. At this time it may be helpful to do contrast studies.

In this group of cases there are seven reoperations. Five of these patients had been operated upon by the senior author the first time. One of the two patients who had been operated upon elsewhere had recurrent low back pain and sciatic pain on the opposite side of the original lesion. This recurrence followed an injury. At the first operation a disc had been removed at L5 left. Reoperation revealed a disc at L5 right. The patient made an uneventful recovery. The second patient who had been operated upon elsewhere had continued to have pain since the first operation. A disc had been removed at L5 previously. Both L4 and L5 spaces were reexplored and a loose piece of cartilage was located at L4. This is another example of a migratory disc. This patient could have been relieved of his pain at the first operation had both interspaces been thoroughly investigated. This patient also was relieved of his pain. These cases were not classified as poor results for this series.

Of the five remaining patients who had a second operation, three had been asymptomatic for periods of four, five and seven years after the original procedure. In each of these cases there was an injury preceding recurrence of pain. One patient had a herniated disc on the opposite side but at the same level of the original herniated disc. The third patient had a recurrent protrusion at the site from which the original disc was removed. These three patients

had excellent results following the second operation. We did not consider recurrence of this type a poor result.

At this point it is interesting to note that only two patients in this series had a recurrent disc at the level of the original lesion. One was on the opposite side and the other on the same side. Both of these patients were seen prior to the time we started curetting the disc space and removing all material possible. We realize it is impossible to remove all of the disc substance, but it is our opinion that given a suitable period of time for healing, the patient will have a stronger back if the disc space is curetted and all possible disc removed. The patient has more pain immediately postoperatively when the disc space is thoroughly curetted than if only the protruded disc is removed with a disc forceps. However, the patient has less chance of a recurrence at the same level if a thorough currettement is done.

Two of the patients who required reoperation for continued pain gave no history of re-injury. One patient required reoperation one and a half years after the original procedure. A disc had been removed at L5 previously. Apparently a disc had been missed at L4 but was found the second time and removed. The nerve root S1 at the site of the first operation was bound down in scar tissue and may have produced some of this patient's pain. This patient continued to have pain and was regarded as having a poor result. The other patient was also reoperated upon a year and a half after the original procedure. This patient had had a disc removed at L5 originally. At reoperation a loose piece of cartilage was found beneath the nerve root S1 in the intervertebral foramen. This was removed. The interspace at L4 was again explored and thought to be negative for a herniated disc. This patient continued to have pain and was seen by another neurosurgeon about one year later. The patient was again explored and after laminectomy was performed at L5 a disc was found and removed at the L4 to L5 interspace. This patient still has pain that is incapacitating and the result has to be regarded as poor.

The problem of fusion at the time of disc removal versus simple removal of the disc has been a controversial subject for several years. Recent articles would indicate that enthusiasm for the combined operation is waning.[9–11] In our opinion, clear-cut indications for fusion are few. We do not favor fusion at the time of disc removal unless there is a definite bony abnormality such as spondylolisthesis or facetal anomalies. Only two patients in this series required fusion for continued low back pain. The added risk to the patient and the extended hospitalization which accompany fusion are considerable and should be avoided if possible.

There was one death in this series of cases. This is the only mortality to date in over 800 consecutive patients operated upon for a herniated disc.

This patient was a thirty-six year old moderately obese white woman. The preoperative findings indicated a herniated disc located at L4 on the right. At operation a herniated disc was found at L4 and removed. Brisk venous bleeding was encountered from distended epidural veins. Approximately 700 cc. of blood were lost before the bleeding could be stopped. The operation was completed and dressing was being applied when the anesthetist stated that the blood pressure had suddenly dropped to 50/0. Plasma was administered immediately and whole blood shortly thereafter. After one hour with the patient in the Trendelenburg position receiving stimulants and whole blood the blood pressure was 70/20. It was thought that the patient might again be bleeding from some ramification of the epidural venous plexus. The wound was reopened and slight venous bleeding (200 to 300 cc.) controlled. The patient remained in shock despite all of the usual treatment and expired shortly after the second procedure was finished. We were unable to obtain a postmortem examination. It was our belief that there was some explanation for this patient's death other than blood loss but we were unable to verify this.

SUMMARY

1. An analysis has been presented of 366 consecutive patients operated upon for a herniated disc from November, 1944 to July, 1950.

2. Diagnosis is discussed from the standpoint of history and neurologic examination.

3. X-rays of the lumbar spine are of greatest value in ruling out tumors or anomalies involving the bony structure. Myelograms are used only in cases of suspected tumors.

4. The operative findings are presented with a discussion of some of the lesions that may not be properly dealt with at times.

5. There are five lesions other than herniated discs producing root pain.

6. The results in this series were good in 82 per cent, fair in 15.2 per cent and poor in 2.4 per cent. Seven patients required reoperation and only two patients required fusion.

REFERENCES


1. Jelsma, F. Clinical analysis of 1,000 consecutive cases of low back pain. *South. M. J.*, 37: 372–378, 1944.
2. Bradford, F. K. and Spurling, R. G. The Intervertebral Disc. Springfield, Ill., 1945. Charles C Thomas, Publisher.
3. O'Connell, J. E. A. Protrusion of the intervertebral disc. *J. Bone & Joint Surg.*, 338: 8–30, 1951.
4. Roofe, P. G. Innervation of annulus fibrosis and posterior longitudinal ligament. *Arch. Neurol. & Psychiat.*, 44: 100–103, 1940.
5. Keegan, J. J. Dermatome hypalgesia associated with herniation of intervertebral disc. *Arch. Neurol. & Psychiat.*, 50: 67–83, 1943.
6. Toumey, J. W., Poppen, J. L. and Hurley, M. T. Cauda equina tumors as a cause of the low back syndrome. *J. Bone & Joint Surg.*, 32-A: 249–256, 1950.
7. Ford, L. T. and Key, J. A. An evaluation of myelography in the diagnosis of intervertebral disc lesions in the low back. *J. Bone & Joint Surg.*, 32-A: 257–266, 1950.
8. Ploetner, E. and Jelsma, F. Concerning painful spina bifida occulta. (In press.)
9. Alfred, K. S. Surgical treatment of herniated lumbar intervertebral discs. *Am. J. Surg.*, 81: 390–400, 1951.
10. Garceau, G. Simple disc surgery versus combined operation. *South. M. J.*, 44: 213–216, 1951.
11. Caldwell, G. A. and Sheppard, W. B. Criteria for spine fusion following removal of protruded nucleus pulposus. *J. Bone & Joint Surg.*, 30-A: 971–980, 1948.

Large incisional hernias can be satisfactorily repaired by reflecting a flap of abdominal aponeurosis or by free transplants of fascia lata obtained from the lateral aspect of the thigh. The latter is the simpler procedure. These fascial transplants can be held in place by wire sutures or silk, or sutures of fascia lata. In fact, interlacing sutures of fascia lata *per se* will make an excellent repair provided the ventral hernia is not too large (*Richard A. Leonardo, M.D.*)

# STUDIES ON 5-AMINOACRIDINE IN EXPERIMENTAL APPENDICEAL PERITONITIS*

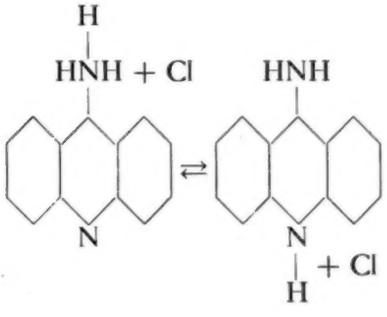
PAUL NEMIR, JR., M.D., H. H. ZINSSER, M.D., H. A. BEAUDET, M.D. AND H. R. HAWTHORNE, M.D.

*Philadelphia, Pennsylvania*

IN a previous communication[1] studies on the *in vitro* effectiveness of 5-aminoacridine against the organisms usually found in peritonitis indicated that this agent was equally or more effective than penicillin, streptomycin, sulfadiazine or a combination of these drugs. In the hope that 5-aminoacridine might prove a useful adjunct in the treatment of peritonitis studies were undertaken to investigate the pharmacology and toxicology of the drug on parenteral administration. As a further step, the drug was also administered to animals with fulminating peritonitis. This article is concerned with these subsequent studies.

## METHODS OF ESTIMATION OF 5-AMINOACRIDINE IN BODY FLUIDS AND TISSUE

*Direct Extraction.* Five-aminoacridine is a strong base and much of its bacteriostatic effect depends upon its complete ionization in the therapeutic concentrations commonly obtained. The effect of ionic resonance on bacteriostasis is apparently negligible[2] although the structure is capable of resonance between the two forms in acid solution within the pH range 2.0 to 7.0. On this resonance effect depends




the fluorescent assay method of Martin and Alpert[3] which was used extensively throughout the course of the experimental work. The method is essentially similar to that for atabrine[4] except that the solvent used was a mixture of ether: isoamyl alcohol (8:2) instead of ether alone. The method, originally devised for urine, can be used in the analysis of blood, plasma, serum, cerebrospinal fluid, bile and peritoneal exudate provided certain variables are properly controlled:

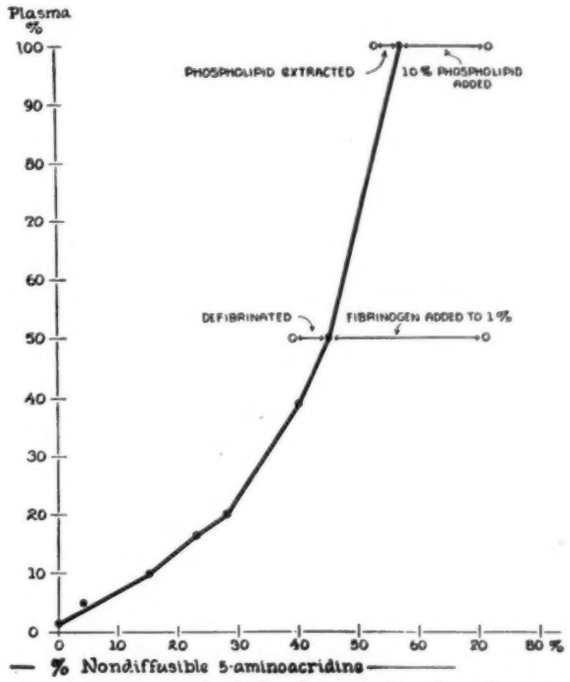



FIG. 1. Per cent of whole plasma plotted against per cent of non-diffusible 5-aminoacridine showing variation with (1) dilution; (2) presence or absence of fibrin; (3) presence or absence of phospholipid.

*Effect of proteins:* Five-aminoacridine is bound to a varying extent to a variety of proteins (Table 1, Fig. 1) and is not completely extractable by the method of Martin and Alpert from such combination with plasma proteins. Recovery from whole blood was usu-

* From the Harrison Department of Surgical Research, Schools of Medicine, the Department of Surgery, Graduate School of Medicine, University of Pennsylvania, Philadelphia, Pa. Aided by a grant from the National Drug Company, Philadelphia, Pa., who kindly provided generous supplies of 5-aminoacridine.

ally 80 per cent or better in the range in which we worked. The dissociable fraction varies inversely with basic strength as shown by the greater proportion of the non-diffusible acridine shown by 2-methyl-9-aminoacridine (Table 1), a stronger base.

TABLE 1
PER CENT NON-DIFFUSIBLE ACRIDINE WITH VARIOUS VEHICLES DETERMINED WITH VISCOSE MEMBRANES

| Vehicle | 5-Amino-acridine (Per cent Bound) | 2-Methyl-9-amino-acridine (Per cent Bound) |
|---|---|---|
| Whole plasma | 57 | .. |
| Knox P-20 gelatin | 41 | 87 |
| Knox heavy gelatin | 60 | 62 |
| Albumin | 20 | .. |
| Amfetin* | 12 | .. |
| Exudate | 9.9 | .. |
| Control P.S.S. | 1.9 | .. |
| Positive-negative gelatin | 86 | .. |
| Agar | 93 | .. |
| Basic fibrin acridine† | 41 | .. |
| 10% plasma | 15 | 58 |
| 50% plasma | 45 | 75 |

* Amfetin,® amniotic fluid concentrate.

† Basic fibrin acridine-aged dog plasma saturated with 5-aminoacridine by allowing to stand in icebox overnight. The somewhat turbid supernatant was then decanted and allowed to precipitate over two weeks after which time it was centrifuged and the precipitate redissolved in 0.2 normal base, which in turn was brought back to pH 7.5. This formed a solution which showed marked Tyndall effect and contained approximately 10 per cent fibrin by weight by trichloroacetic acid precipitation.

*Effect of lipoid concentration:* Preliminary alcohol-ether extraction of whole plasma reduced the amount of non-diffusible acridine bound to plasma proteins. This would be expected from the results of Christensen and Hastings[5] on the non-diffusibility of plasma phospholipid and the high lipoid: water distribution coefficient shown by the acridine derivatives.[2] Indirect evidence of the effect of lipoid in decreasing extractability was derived from the relative partition of 5-aminoacridine within and without the red cell of the dog determined after saponization. (Fig. 2.) Further evidence was obtained directly by determination on washed red cells and indirectly by means of difference in whole blood and plasma samples.

*Effect of specific plasma fractions:* The solubility of 5-aminoacridine in plasma has been reported[2] but we were unable to get a constant figure for plasma from different dogs. One source of variation was found to be a rather specific reaction between plasma fibrinogen and

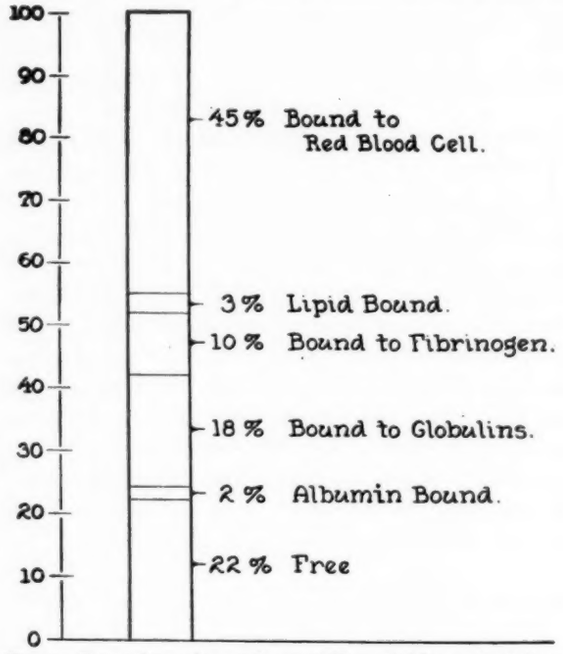


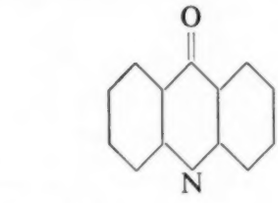

FIG. 2. Partition of 5-aminoacridine within and without the red cell.

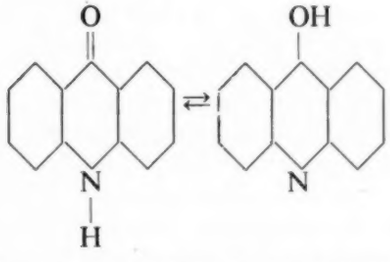
5-aminoacridine. Increasing the concentration of acridine above 60.0 mg. per 100 cc. invariably produced a precipitate if the sample were aged twenty-four hours or more. The amount of precipitate and the speed of its formation increased in proportion to the excess of 5-aminoacridine present in the system. Analysis of the precipitate so formed showed: (1) that the compound was reversibly dissociable with dilution as estimated by diffusible 5-aminoacridine; (2) that the protein portion of the flakey amorphous precipitate had the solubility characteristics of fibrinogen; and (3) that purified fibrinogen formed a similar precipitate with 5-aminoacridine with approximate combining proportions 1:2 (computed on molecular weight 400,000 for fibrinogen).

*Hydrolysis Methods.* The analysis of tissues by the direct extraction method was not thought to be accurate and the results were extremely difficult to interpret in view of microscopic evidence of high fat content of many of the tissues analyzed. The difficulties attendant on direct extraction stem from the

high protein content of the tissue homogenate analyzed, the high phospholipid and cholesterol content of tissues as contrasted with urine or plasma and the concomitant finding of gel formation whenever adequate mixing in the course of extraction was attempted. For these reasons it was believed that some more indirect method involving hydrolysis of NH CO bonds might yield more accurate results in the analysis of tissue samples.

When it became apparent that losses in the course of direct extraction were significant, hydrolysis was attempted both with acid and base. Losses in fluorescent acridine were encountered by either procedure. In the analysis of blood containing 4.0 gamma per cc. hydrolyzed twenty hours with 0.1 normal hydrochloric acid the loss was 40 per cent and with 10 normal sodium hydroxide almost twice that magnitude. The hydrolysis of 5-aminoacridine by acid and base presumably yields the acridone whose electronic structure is somewhat uncertain but which should be both fluorescent and colored as it may be written to resonate between




The color is described in the literature[6] but no fluorescence is mentioned. By prolonged heating (140°C.) with concentrated hydrochloric acid a greenish crystalline salt was obtained having most of the reactions and the same fluorescence of the original 5-aminoacridine, and by alkaline hydrolysis a white, non-fluorescent powder was obtained. For this reason and the empirically lower loss found in acid-hydrolysed blood samples, acid hydrolysis was chosen for further investigation and formic acid was added to the hydrochloric acid to prevent oxidation and polymerization at the amino group. Control hydrolyses using this method yielded 80 to 85 per cent of original added 5-aminoacridine with tissues.

## PHARMACOLOGY AND TOXICOLOGY

The toxicity of the acridine group has been well known for some time and it has been the chief deterrent to more widespread use of the original derivatives, acriflavine and proflavine. Not only is the therapeutic dose close to the lethal dose when administered systematically, but also quantities in the range of one-fourth to one-half the lethal dose give rise to a variety of side reactions ranging from mild nausea, vomiting and diarrhea[7] to varying degrees of liver damage.[8–11]

Similar effects of 5-aminoacridine were found in this study in mice and dogs.

*Lethal Dose.* A 0.1 per cent solution of 5-aminoacridine hydrochloride in isotonic saline was given in varying amounts by intragastric intubation and by intraperitoneal injection, into mice weighing between 15 and 20 gm. The L. D. 50 was found to be 65.0 mg. per kg. in the latter group and 75.0 mg. per kg. when administered by intragastric intubation. This is in agreement with previously reported figures[2,12] and is in the range of the fatal dose found by us for dogs.

*Sublethal Dose.* Intravenous and intraperitoneal injections of sublethal doses in mice and dogs have revealed certain pathologic changes:

1. Liver damage almost invariably occurred following daily intraperitoneal injections into mice of 20.0 mg. per kg. of the drug in isotonic saline for periods of two and three weeks. Areas of focal necrosis, atrophy of the liver parenchyma, extensive lipoid deposition and degeneration of the nuclei were found. Following withdrawal regenerative changes did occur but after two weeks injury was still evident. Our studies with dogs also indicated that liver damage occurred following repeated administration and, further, in the face of pre-existing liver damage the drug was much more toxic.

2. The leukocytosis reported by Meleney and Zau[13] in rabbits using intravenous neutral acriflavine was also found to occur following the intravenous administration of 5-aminoacridine into rabbits. We noted no significant alteration of the red blood cells.[14]

3. The drug manifests both central nervous stimulation and parasympathomimetic reac-

tions in amounts used by us. The reactions of the dog following 20.0 mg. per kg. of 5-aminoacridine in isotonic saline by rapid drip into a leg vein were generally constant and striking. Intense excitement, muscular fibrillations, hypersalivation and hyperperistalsis occurred

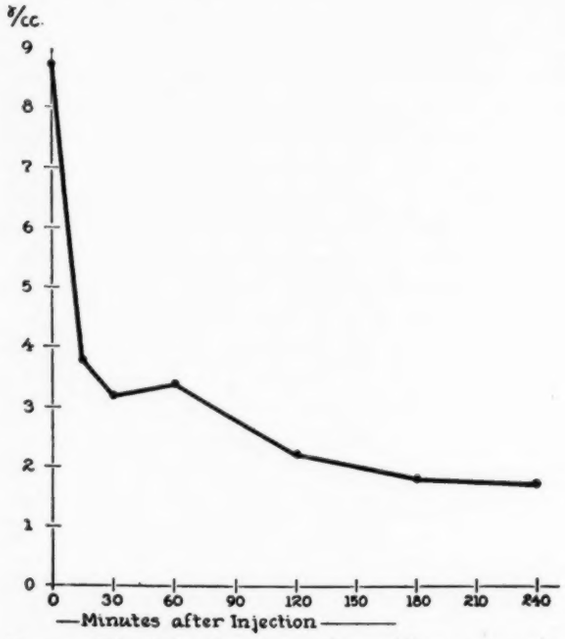



FIG. 3. Blood levels of 5-aminoacridine at varying intervals following intravenous administration of the drug in physiologic saline solution.

almost immediately following injection. Hypersalivation and diarrhea were invariable findings and occurred even with lower dosages. Several minutes following injection the muscular twitchings and fibrillations would become more severe; the animal would be unable to stand and paresis of the hind limbs was manifested. The reactions would subside in two and a half to three hours. The reactions varied directly according to the dose and the rapidity of administration.[13] By giving atropine before injection we could completely annul the hypersalivation and diarrhea, and veterinary sodium pentobarbital was quite effective in offsetting the violent neuromuscular manifestations. It was believed, however, that administration of 5-aminoacridine prolonged the anesthetic effect of sodium pentobarbital. Whether this was due to a common path of elimination or more directly to detoxification competition cannot be determined from our data.

*Distribution and Disposition in Body Fluids and Tissues.* The distribution and disposition of the drug in the body fluids has been determined following the intravenous injection of 20.0 mg. per kg. of the drug in isotonic saline into dogs. At first one-twelfth and one-sixth of the minimal lethal dose was given and tolerated well by the animals but immediate blood levels

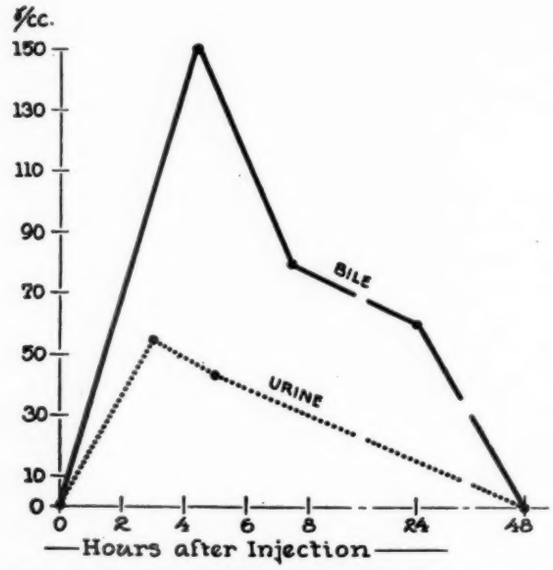



FIG. 4. Excretion in bile and urine following 20 mg./kg. of 5-aminoacridine intravenously.

never revealed a concentration over 1.0 gamma per cc. Twenty mg. per kg. were then employed as the unit dose. Immediate blood levels revealed a concentration of around 9.0 gamma per cc. which rapidly disappeared in two to three hours. (Fig. 3.) In three animals excretion of the drug in the bile, utilizing the method of Rous and McMaster,[15] and in the urine was carried out. High concentrations of the drug in the bile were obtained between four and six hours after injection and appreciable levels were still present at twelve and occasionally at twenty-four hours. (Fig. 4.) Urine concentrations were high at two to four hours and then declined. (Fig. 4.) The drug was also found to be present in the spinal fluid but concentrations were in the range of 1.0 gamma per cc.

Although there was a rather wide variation in the concentrations obtained in bile and urine in the different experiments, it was found that the total amount of drug excreted in the bile and urine was rather constant, ranging between 0.7 and 3.5 per cent in the bile, and in urine between 0.7 and 1.5 per cent. Thus only about 4 to 5 per cent of the drug can be

accounted for in these excretory channels. That the remainder was bound to the tissues seemed likely and was further indicated by the finding of a yellowish green fluorescence when injected mice were examined under ultraviolet light. Total extraction of whole mice was then carried out in an effort to account for the absent 95 per cent.

Intact mice were placed in small glass containers with conventional water bottles. They were then given 20.0 mg. per kg. of the drug in isotonic saline intraperitoneally for three injections at four-hour intervals. The mice were sacrificed at twenty-four hours and the contents of the containers and the mice were extracted separately after grinding and formic acid-hydrochloric acid hydrolysis. A control was run by dividing a calculated dose of acridine into two equal portions, placing one portion in an empty cage with a small amount of water and the other portion in the peritoneal cavity of a sacrificed animal just prior to freezing and grinding. As stated, the recovery in the controls was in the range of 85 per cent. In the animals receiving 60.0 mg. per kg. of 5-aminoacridine in divided doses we were able to recover an average of 8.3 per cent in the cage washings and 9.7 per cent from the ground-up whole mice. An average of 82 per cent of the drug remained unaccounted for and was presumably metabolized or changed to some other compound not detectable by the method of extraction and analysis used.

### THERAPEUTICS

*Intravenous Administration.* Although serious toxic manifestations were encountered following systemic administration of 5-aminoacridine, the bacteriostatic effectiveness of the agent is of such magnitude[2,16,17] it was believed that if the same effectiveness could be secured *in vivo* as *in vitro* work on physiologic antagonists would be well worth while. However, we were unable to demonstrate this. As stated, very high concentrations were obtained in the bile but in spite of these concentrations we were never able to sterilize the biliary tree of three dogs infected during the course of bile sample collection even after repeated administration of the drug up to the lethal dose. Five-aminoacridine, mixed with sterile dog bile, was quite effective against typical biliary pathogens *in vitro* (Table II) but was ineffective when derived from intravenous injection and passage through an infected biliary tree. Whether this was due to conjugation and inactivation of the drug by the liver or the presence of other components consequent to infection of the biliary tree[18–20] was not determined.

TABLE II
CONCENTRATION OF 5-AMINOACRIDINE EFFECTIVE IN INHIBITING GROWTH OF TYPICAL BILIARY PATHOGENS IN BROTH AND IN STERILE DOG BILE*

| | Hemolytic Staphylococcus Aureus | Hemolytic Streptococcus | Bacillus Coli | Bacillus Welchii |
|---|---|---|---|---|
| Broth..... | 1:256,000 (4γ) | 1:256,000 (4γ) | 1:512,000 (2γ) | 1:512,000 (2γ) |
| Bile and broth... | 1:128,000 (8γ) | 1:128,000 (8γ) | 1:256,000 (4γ) | 1:256,000 (4γ) |

* Sixteen-hour growths of the organisms were used for the tests. In preparing the bile plus broth media 0.50 cc. of sterile dog bile was added to 19.0 cc. of broth plus acridine. The amount of organisms used was such that in the final dilution there were 1,000,000 organisms per cc. of media. The plates were read after 24 and 48 hours incubation at 37°C.

The possible use of the drug intraperitoneally offered a more promising avenue of investigation. Preliminary experiments indicated that the side effects were either absent or very minor following the intraperitoneal injection of the unit dose and collateral experiments[1] had indicated that a concentration of acridine in the range of 100 gamma per cc. or more, maintained for twenty-four hours or longer, was decidedly effective in decreasing the number of organisms in peritoneal exudate from an induced, fulminating appendiceal peritonitis. Our next step was to determine if these levels could be obtained for an appreciable length of time in normal animals in which chemical peritonitis had been created by the injection of 20.0 cc. of tragacanth aleuronat (1.5 per cent tragacanth, 0.5 per cent aleuronat).

*Intraperitoneal Injections.* In an effort to maintain levels of acridine within this range for an appreciable length of time on intraperitoneal injection, various vehicles were tried. With saline as the vehicle the concentrations of the drug in the peritoneal fluid

were negligible at four hours. P-20 gelatin (Knox), positive-negative (coacervate P-20 and positive gelatin) gelatin, plasma and peanut oil were then used as vehicles. However, only with plasma were we able to maintain effective levels for twenty-four hours, and in several of these experiments levels of over 200 gamma per cc. were present at this time.

To determine whether or not the drug would have any effect *in vivo* when given in this manner we created fulminating peritonitis in eight dogs by ligating and slitting the appendix after the method of Zintel and his associates,[21] and instilled the drug locally at the conclusion of the operation. Plasma was used as the vehicle in five animals, saline in two and peanut oil in one. The unit dose of 20.0 mg. per kg. was used in all animals. All of the dogs died between five and twenty-one hours, with an average survival time of fourteen and a half hours. In only two (one dying at five hours and the other at eleven hours) were appreciable concentrations of the drug present at death and in no case was there any essential alteration of the bacterial flora.[22]

## SUMMARY AND CONCLUSIONS

The intravenous and intraperitoneal injection of 5-aminoacridine in various vehicles has been studied. When administered parenterally approximately 18 per cent of the drug can be accounted for through excretion in the bile and urine and absorption by the body tissues. Eighty-two per cent of the drug remained unaccountable by the methods we have used, and presumably was metabolized.

With a unit dose amounting to almost one-third of the minimal lethal dose therapeutic levels could not be obtained for any length of time following intravenous injection by our methods. The side reactions encountered were severe and, further, liver damage was shown to occur following prolonged administration. The toxic manifestations were shown also to be increased in the face of pre-existing liver damage.

A therapeutic level may be obtained in the biliary passages following intravenous injection but apparently the effectiveness of the drug is in some manner neutralized by passage through the liver as we were never able to sterilize an infected biliary tree.

Intraperitoneal administration of 5-aminoacridine as an adjunct in the treatment of peritonitis does not appear feasible with the methods and dosages employed by us. Although our *in vitro* bacteriologic studies on peritoneal exudate indicated that 5-aminoacridine in concentrations over 100 gamma per cc. was more effective than any of the other antibacterials used, we could not consistently maintain this level for sufficient lengths of time following intraperitoneal administration of the unit dose in various vehicles. However, other methods whereby a smaller amount of the drug combined with some agent which could prevent such rapid absorption might prove more effective for this type of utilization of the drug.

## REFERENCES

1. Nemir, P., Jr., Zinsser, H. H., Long, E. E. and Hawthorne, H. R. Studies on 5-aminoacridine. 1. In vitro bacteriologic evaluation on peritoneal exudate from induced fulminating peritonitis. *Arch. Surg.*, 62: 493, 1951.
2. Rubbo, S. D., Albert, A. and Maxwell, M. Influence of chemical constitution on antiseptic activity; study of monoaminoacridines. *Brit. J. Exper. Path.*, 23: 69, 1942.
3. Martin, G. J. and Alpert, S. Unpublished data.
4. Auerbach, M. E. and Eckert, H. W. Photofluorometric determination of atabrine. *J. Biol. Chem.*, 154: 597, 1944.
5. Christensen, H. N. and Hastings, A. B. Phosphatides and inorganic salts. *J. Biol. Chem.*, 136: 387, 1940.
6. Beilstein. Handbuch der organischen Chemie, vol. 21, p. 335. Edited by Prager, B. and Jacobson, P. Berlin, 1935. Julius Springer.
7. Davis, E. Urinary antisepsis; clinical results following the oral administration of acriflavine. *J. Urol.*, 11: 29, 1924.
8. Birch, C. A. Acute toxic hepatitis after acriflavine. *Lancet*, 1: 269, 1931.
9. Heathcote, R. St. A. and Urquhart, A. L. Pharmacological and toxicological actions of acriflavine. *J. Pharmacol. & Exper. Therap.*, 38: 145, 1930.
10. Hanschell, H. M. Acute toxic hepatitis after acriflavine. *Lancet*, 1: 269, 1931.
11. Cullinan, E. R. Acute toxic hepatitis after acriflavine. *Lancet*, 1: 218, 1931.
12. Ungar, J. and Robinson, F. A. Investigation of antibacterial and toxic action of certain acridine derivatives. *J. Pharmacol. & Exper. Therap.*, 80: 217, 1944.
13. Meleney, F. L. and Zau, Z. D. Action of acriflavine on the blood and certain tissues of rabbits—with particular reference to hemolytic streptococcus septicemia. *J. A. M. A.*, 84: 337, 1925.
14. Bohland, K. Intravenöse Anwendung des Trypaflavins bei Infektionskrankheiten. *Deutsche med. Wchnschr.*, 45: 797, 1919.

15. Rous, P. and McMaster, P. D. A method for the permanent sterile drainage of intra-abdominal ducts, as applied to the common duct. *J. Exper. Med.*, 37: 11; 1923.
16. Albert, A., Rubbo, S. D., Goldacre, R. J., Davey, M. E. and Stone, J. D. Influence of chemical constitution on antibacterial activity; general survey of acridine series. *Brit. J. Exper. Path.*, 26: 160, 1945.
17. McIntosh, J. and Selbie, F. R. Zinc peroxide, proflavine and penicillin in experimental Cl. welchii infections. *Lancet*, 2: 750, 1942.
18. Fleming, A. The physiological and antiseptic action of flavine. *Lancet*, 2: 341, 1917.
19. Eggerth, A. H. The bactericidal action of acridine dyes and the adjuvant effect of serum. *J. Infect. Dis.*, 38: 440, 1926.
20. Hewlett, R. T. The germicidal power of flavine. *Lancet*, 2: 493, 1917.
21. Zintel, H. A., Wiley, M., Nichols, A. and Rhoads, J. E. The use of streptomycin in surgical patients. *Surgery*, 21: 175, 1947.
22. Steinberg, B. Infections of the Peritoneum. Philadelphia, 1944. Paul B. Hoeber, Inc.

Ordinarily, simple closure is efficacious in the management of acute perforation of a peptic ulcer. However, if a calloused ulcer perforated, occasionally simple closure may not be advisable, especially in the presence of friable tissue wherein the sutures pull out. In such instances partial gastrectomy may be needed. Rarely, if one is certain the perforation has become walled off and the patient is improving (and this can be ascertained only in perforations of many hours' duration or in those a day or two old), non-operative therapy may be prescribed. (*Richard A. Leonardo, M.D.*)

# SOME UNCOMMON CAUSES OF APPENDICEAL MUCOCELE

JOHN R. HILSABECK, M.D.,*
Fellow in Surgery, Mayo Foundation, University of Minnesota
LEWIS B. WOOLNER, M.D. AND EDWARD S. JUDD, JR., M.D.
Division of Surgical Pathology, Mayo Clinic — Division of Surgery, Mayo Clinic
*Rochester, Minnesota*

IN vivo studies[11–13] of human beings and animals have established the appendix as a secretory organ which will continue to secrete despite obstruction. The fate of the obstructed appendix in animals is known to be acute appendicitis in the presence of, or mucocele in the absence of, infection. As a matter of fact, mucoceles can be produced consistently in most instances in dogs and rabbits by merely ligating the base of the appendix provided the appendiceal lumen is washed prior to ligation.

Available data indicate that mucocele occurs in human beings when the prerequisites found necessary for experimental production of mucocele in animals are fulfilled. Thus a mucocele is likely to be produced in human beings or animals whenever secretion into the appendiceal lumen exceeds loss from it by drainage and by absorption, provided marked intraluminal contamination is absent. Presumably in human beings when proximal blockage is gradual the appendix is able to rid itself of luminal infection by washing out the bacteria, much as isolated segments of bowel sterilize themselves.[2] In such a case reintroduction of bacteria would be prevented since the increasing intra-appendiceal pressure effected by continued secretion and progressive obstruction would be higher than the intracecal pressure. That the contents are relatively free of infection is well known and is borne out clinically by the sterile peritonitis resulting from intraperitoneal rupture of the mucocele.

The most common factor responsible for formation of mucocele in human beings is obstruction of the appendiceal lumen by cicatricial contraction. Most of the 146 mucoceles reported by Woodruff and McDonald developed distal to a luminal stenosis, which was usually the result of chronic inflammation. Appendiceal drainage need not cease altogether to achieve formation of mucocele, nor must intraluminal obstruction be the result of fibrosis. There are reports of mucoceles developing after obstruction from other causes besides inflammatory stricture and Dodge has reported five cases in which obstruction was not present, the lumen being patent in each case.

It is the intent of this communication to present and to consider briefly eleven cases of mucocele of the appendix removed surgically at the Mayo Clinic in which the mucocele was not the result of inflammatory stricture. During the forty-year period which was reviewed appendiceal mucocele had been removed surgically in 258 cases.

## FORMATION OF MUCOCELE DESPITE PATENT APPENDICEAL LUMEN

Dodge found reports of five cases of appendiceal mucocele in the literature which developed although the lumina were patent. Since then Vorhaus and Latimer have each reported a case of mucocele with an unobstructed lumen and, reportedly, Lifvendahl and Ries have observed a similar instance. Since none of the observers mentioned the presence of any cecal lesion, it is not clear why a mucocele was formed in these cases. Dodge was unable to find a cause for the mucoceles in any of the five cases which he reviewed. He suggested that the fault might have been a defective muscularis propria not strong enough to empty the appendix of secretion.

Seven cases of mucoceles which developed despite patent appendiceal lumina were encountered at the clinic. In all seven cases the mucoceles were associated with carcinoma in the right portion of the colon. In one case, Case VII, the mucocele was most likely the result of incomplete evacuation of appendiceal secretion subsequent to back pressure from the obstruc-

* Now of Santa Ana, California.

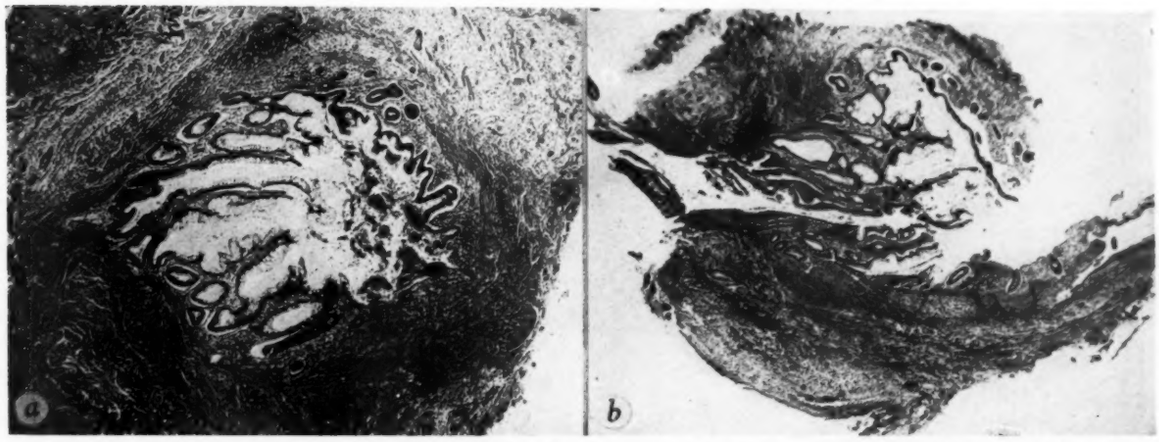


FIG. 1. Case 1. Patent proximal appendiceal lumen. (*a*) Gross section, hematoxylin and eosin, × 28; (*b*) sagittal section, hematoxylin and eosin, × 15.

tion in the ascending colon. In each of the others mucocele was produced because the patent appendiceal orifice was partially obstructed by the growth in the cecum. Evidently drainage was impeded just enough so that continued appendiceal secretion could not be entirely expelled and, in the absence of marked infection, mucoceles were formed.

### CASE REPORTS

CASE 1. A man fifty-nine years of age was operated upon because of roentgenographic demonstration of a large polypoid carcinoma of the ascending colon in the region of the hepatic flexure and a pedunculated polypoid lesion 2 cm. in diameter in the descending colon above the level of the iliac crest. The terminal ileum, cecum, appendix, ascending colon and a portion of the transverse colon were resected. The sigmoidal polyp was removed transcolonically. Pathologic examination of the surgical specimen revealed an annular, ulcerative, mucous adenocarcinoma of grade III, 10 by 6 by 2 cm. The serosa was involved but there was no nodal involvement. The appendix was the site of an unruptured mucocele 8 by 2 by 2 cm. which communicated freely with the cecum. The carcinoma had partially obstructed the base of the appendix to produce an unruptured mucocele. (Fig. 1*a* and *b*.)

CASE II. A woman sixty-eight years of age was operated upon because of a large mass in the right portion of the abdomen. A radical right hemicolectomy with removal of a portion of the terminal ileum was performed. Pathologic examination of the surgical specimen revealed an ulcerated adenocarcinoma of the cecum, grade III, which also had involved the base of the appendix, partially obstructing it and producing a mucocele 2 by 1.5 cm. Three regional lymph nodes were involved by the carcinoma.

CASE III. A woman sixty-two years of age was operated upon because of roentgenographic demonstration of a polypoid lesion in the cecum. An exteriorization procedure was performed removing a portion of the terminal ileum, cecum, appendix and half of the right portion of the colon. Pathologic examination of the surgical specimen revealed an ulcerated, colloid adenocarcinoma of grade II, 5 by 5 by 3 cm., which had been situated in the cecum just over the opening of the appendix. This had partially obstructed the appendiceal lumen to produce a large unruptured mucocele.

CASE IV. A man fifty-four years of age was operated upon because of a palpable, large, mobile mass in the right mid-portion and lower portion of the abdomen which roentgenographically appeared to be a polypoid cecal lesion. Radical right hemicolectomy was performed. Pathologic examination of the surgical specimen revealed a polypoid, intussuscepting, mucous adenocarcinoma of high grade I, 8 by 6 by 4 cm. There was no nodal or serosal involvement. The lesion partially obstructed the lumen of the appendix producing an appendiceal mucocele 12 by 2 by 2 cm.

CASE V. A male sixty-two years of age, who fourteen years before had undergone a two-stage combined abdominoperineal resection at the clinic because of adenocarcinoma, grade II, of the rectum, again underwent operation because of roentgenographic demonstration of a lesion in the cecum. Radical right hemicolec-

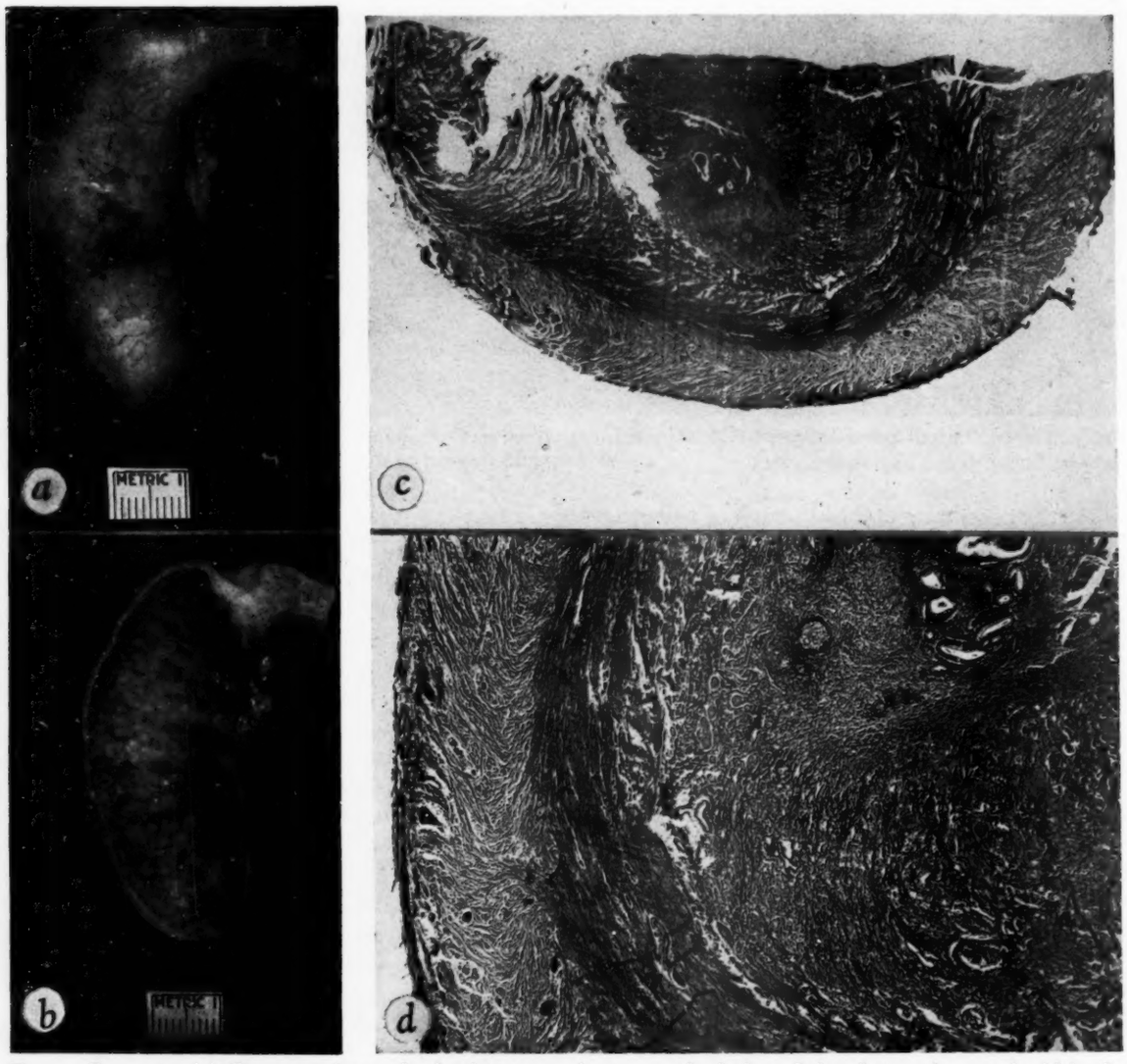



FIG. 2. Case VIII. (*a*) Gross specimen obtained at operation; note the bulge of the obstructing carcinoid in the proximal portion of the appendix; (*b*) sagittal section demonstrating the carcinoid completely blocking the appendiceal lumen with the production of a mucocele distally; (*c*) hemisection of appendix taken under low power at the point of obstruction showing the carcinoid intraluminally, hematoxylin and eosin, × 8; (*d*) portion of specimen shown in (*c*) under high power, hematoxylin and eosin, × 20.

tomy was performed. Pathologic examination of the surgical specimen revealed an ulcerative, perforating adenocarcinoma, grade I, 7 by 6 by 4 cm. It had partially obstructed the orifice of the appendix to produce a mucocele 5 by 2 by 2 cm. which was intact. The carcinoma had involved the serosa and regional lymph nodes.

CASE VI. A woman fifty-nine years of age was operated upon because of roentgenographic demonstration of a lesion considered to be carcinoma of the cecum. A two-stage radical right hemicolectomy was performed. Pathologic examination of the surgical specimen revealed adenocarcinoma of the cecum, grade II, which also had involved the base of the appendix and had partially obstructed it to produce an unruptured mucocele 6 by 2 cm. The regional nodes were not involved.

CASE VII. A man was operated upon because of an obstructing lesion in the mid-portion of the ascending colon. A non-resectable, annular adenocarcinoma was found in this location with metastasis to the liver and to the regional lymph nodes. The appendix was removed prophylactically since it " . . . was markedly distended and appeared ready to rupture because of the obstruction in the colon." Pathologic examination of the appendix re-

vealed a mucocele 4.5 by 1.5 cm. and a diverticulum. The appendiceal lumen was patent.

### MUCOCELE PRODUCED BY CARCINOID

According to Weiner and Sala theirs was the first case reported in the literature of a mucocele caused by an obstructing carcinoid. Although not recognized as such Harte and Le Conte apparently observed mucoceles produced by a proximally obstructing carcinoid. Harte's description of the gross specimen removed at appendectomy on a forty-one year old man was definitely that of a mucocele, and the histologic description of the yellow material occluding the appendix proximally was that of a carcinoid. Le Conte noted the same thing in the case of a twenty-one year old woman. Garrow and Keenan reported a mucocele that developed distal to an occluding nodule of "cubical cell carcinoma" involving all coats of the appendix. Topping reported a mucocele and a yellowish mass made up of solid groups of cancer cells in the appendix of a twenty year old man, but from his description it is not certain that the probable carcinoid produced the mucocele. Three such cases have been encountered at the clinic.

Case VIII. A man twenty-three years of age was operated upon for acute appendicitis. Pathologic examination of the surgical specimen revealed an acutely inflamed mucocele of the appendix 7 by 3 cm. in size. Complete luminal obstruction was produced proximally by a carcinoid tumor which measured 8 mm. in diameter. (Fig. 2*a* to *d*.)

Case IX. A thirty-seven year old man underwent appendectomy. Pathologic examination of the surgical specimen revealed a mucocele 5 mm. in diameter at the tip of the appendix. Proximal luminal obstruction of the appendix had been produced by a carcinoid 3 mm. in diameter.

Case X. A woman forty-one years of age underwent appendectomy. Pathologic examination of the surgical specimen revealed a carcinoid 6 by 8 by 5 mm. situated 2 cm. from the tip of the appendix. Distal to the constriction produced by the carcinoid was a mucocele 2 cm. in diameter. (Fig. 3.)

### MUCOCELE PRODUCED BY A POLYP

In the literature reviewed no cases of mucocele of this nature were reported. One case has been encountered at the clinic in which a polyp

Fig. 3. Case X. Carcinoid tumor under low power showing occlusion of the lumen, hematoxylin and eosin, × 22.

Fig. 4. Case XI. Cross section through the proximal end of the appendix showing the benign polyp which occluded the lumen. The appendiceal wall has been unfolded.

in the proximal portion of the appendiceal lumen produced a mucocele distal to it.

Case XI. A girl eight years of age underwent ileosigmoidostomy preparatory to undergoing subtotal colectomy for multiple polyposis. The appendix was removed because it was dilated. Pathologic examination of the appendix revealed an adenomatous polyp 2.5 by 8 by 8 mm. which completely occluded the lumen of the appendix in its proximal portion. An unruptured mucocele 9 by 1 cm. was found distal to the polyp. (Fig. 4.)

### MUCOCELE PRODUCED BY ENDOMETRIOSIS

Shemilt was of the opinion that his was the only case on record of an appendiceal mucocele produced by a proximally obstructing endometrial implant. There were two cases in the clinic files of appendices with endometriomal implants associated with a mucocele but the

surgical specimens were so mutilated from previous sectioning that it could not be proved that the endometriomas produced the obstruction.


## SUMMARY

In the absence of marked intraluminal contamination a mucocele of the appendix may be formed whenever the rate of appendiceal secretion exceeds the rate of absorption and proximal drainage. The majority of mucoceles develop distal to an inflammatory stricture. During a forty-year period eleven cases in which the mucocele was not the result of inflammatory stricture were encountered at the clinic. In seven cases the appendiceal lumen was patent, the mucocele being produced by partially obstructing carcinoma of the cecum; in three cases obstruction was caused by a carcinoid, and in one case obstruction resulted from a polyp. Two mucoceles were associated with appendiceal endometriomas but it was impossible to prove that the endometrial tissue had caused obstruction.


## REFERENCES


1. Dodge, G. E. Cystic dilatation of the vermiform appendix: report of a case of hydropic cyst, with a study of 142 cases. *Ann. Surg.*, 63: 334–348, 1916.
2. Dragstedt, L. R., Dack, G. M. and Kirsner, J. B. Chronic ulcerative colitis: a summary of evidence implicating bacterium necrophorum as an etiologic agent. *Ann. Surg.*, 114: 653–662, 1941.
3. Garrow, A. E. and Keenan, C. B. Primary carcinoma of the appendix: report of two cases. *Ann. Surg.*, 48: 560–562, 1908.
4. Harte, R. H. Primary carcinoma and sarcoma of the appendix vermiform. *Ann. Surg.*, 47: 968–999, 1908.
5. Latimer, E. O. Mucocele of the appendix. *Am. J. Surg.*, 47: 124–127, 1940.
6. Le Conte, R. G. Carcinoma of the appendix with metastasis to the ileocolic glands. *Ann. Surg.*, 47: 1000–1005, 1908.
7. Lifvendahl, R. A. and Ries, E. Open communication between appendiceal mucocele and cecum. *Am. J. Surg.*, 17: 270–274, 1932.
8. Shemilt, P. Endometrioma of the caecum causing mucocele of the appendix. *Brit. J. Surg.*, 37: 118–120, 1949.
9. Topping, M. H. Carcinoma with mucocele of appendix: report of a case. *California & West. Med.*, 29: 186–187, 1928.
10. Vorhaus, M. G. Recognition of some of the less common diseases. Duodenal-jejunal diverticula; mucocele of the appendix and the cecum. *J. A. M. A.*, 94: 165–169, 1930.
11. Wangensteen, O. H. and Bowers, W. F. Significance of the obstructive factor in the genesis of acute appendicitis; an experimental study. *Arch. Surg.*, 34: 496–526, 1937.
12. Wangensteen, O. H. and Dennis, C. Experimental proof of the obstructive origin of appendicitis in man. *Ann. Surg.*, 110: 629–647, 1939.
13. Wangensteen, O. H. and Dennis, C. The production of experimental acute appendicitis (with rupture) in higher apes by luminal obstruction. *Surg., Gynec. & Obst.*, 70: 799–806, 1940.
14. Weiner, J. J. and Sala, A. M. Carcinoid tumor of the appendix producing a mucocele. *Am. J. Surg.*, 71: 420–422, 1946.
15. Woodruff, R. and McDonald, J. R. Benign and malignant cystic tumors of the appendix. *Surg., Gynec. & Obst.*, 71: 750–755, 1940.

# SOME PATHOLOGIC ASPECTS OF CUTANEOUS WOUND HEALING

WALLACE MARSHALL, M.D.
*Two Rivers, Wisconsin*

THE important aspects of proper wound healing should be of decided interest to every scientifically minded surgeon. The author wrote on this subject in 1943.[1] Since that time some new concepts have come to our attention on this topic which for our purpose can be divided into the normal and the abnormal phases. Let us review the highlights which have to do with the normal components of wound healing, for the abnormal aspects might be better understood if we consider the factors which are involved in the normal phases.

Indeed, the healing of a skin wound is an amazing phenomenon. Carrel has shown that a wound will not heal within three weeks if all debris and blood clots are removed and the wound is protected from outside irritation; yet if irritation or infection occur, cicatrization will begin in less than two days.[2] Hence tissue injury probably inaugurates a hormonal response by the fibroblasts which migrate to the site of injury and where they then begin to proliferate. This hormonal concept of wound healing can be traced to Virchow (1858). In 1892 Weisner wrote that this traumatic effect was an indirect one since the injured cells released wound hormones which caused the normal cells to proliferate. Naswitis (1924) demonstrated the actual existence of growth-stimulating substances.[3]

The fibroblast is the main unit of repair. Ham[4] states that fibroblasts are the most numerous type of cell in most sections of areolar tissue. These cells form both the collagenic and the elastic fibers of areolar tissue, and they form also the amorphous intercellular substance in which the elastic and collagenous fibers are embedded. Ham[5] has given the following description on the healing of a wound: "It has been explained previously that the blood that flows into the space between the lips of a cut on the skin soon clots. This results in the cut edges, if they are not too far apart, becoming glued together with a fibrin mesh. In a skin wound, such a fibrin mesh is rapidly invaded by fibroblasts and capillaries; the tissue resulting from the growth of these two elements is termed granulation tissue. And, in such a site, it is to be observed that, in a short time, the fibrin disappears and collagen fibers are deposited between the new fibroblasts. The new tissue, rich in collagen, is said to constitute a scar. It is of interest that fibroblasts seem to be essential for the formation of both mucopolysaccharide amorphous intercellular substances and collagenic fibers. Meyer has suggested that in forming intercellular substance the young fibroblast may secrete a non-fibrillar precursor of collagen together with hyaluronic acid and a chondroitin sulfate. The acid amorphous intercellular substance may then denature the precursor of collagen, causing it to become fibrillar, with each fibril having an investment of amorphous substance."

The primary requisites for proper wound healing are well known to most surgeons. Healing by "first intention" requires a clean, accurately approximated surgical wound.[6] Other factors which assist in adequate wound healing are proper asepsis, perfect hemostasis[7] and the careful handling of all viable tissue as advocated by Professor Michael Mason.[8] Conversely, a known factor of importance which has to do with improper wound healing is the relation of hypoproteinemia to wound disruption which was first demonstrated in the dog by Thompson, Ravdin and Frank, who showed that the hypoproteinemic dog is frequently incapable of normal fibroplasia. Also, avitaminosis C is a systemic factor which interferes with proper wound healing,[9] as does lack of rest and good general health, for albuminuria and diabetes particularly obstruct repair[10] and the fibroplastic response to leukotaxine, according to Menkin.[11] Christopher[12] has stated that the effects of vitamins A and D on wound healing are not yet sufficiently established. However, in passing, I have found very recently the concomitant conditions of hypovitaminosis D and the presence of keloids in several patients. Hence I am not too certain that these

two conditions are not interrelated intimately.[13] This topic is now being investigated by the author.

The ultimate end result of a wound can be noted by the presence of a scar which is composed mainly of connective tissue whose fibers are denser and less elastic than those which are found in normal skin. From a cosmetic viewpoint scars are important to the patient, as every clinician knows so well. A fine linear scar is preferred to the irregular, thick and unsightly type; and when the latter is prominent, it may have developed into a hypertrophic scar or a keloid which can be defined in pathologic terms as non-inflammatory fibroma.[14] Lever[15] writes that there are two types of keloids, (1) the primary or spontaneous and (2) the secondary or post-traumatic. He claims that the two types do not differ clinically or histologically. Lever states that "primary keloid, which represents a true tumor, presents the same histological appearance as a dermatofibroma. The cells of the tumor show no phagocytosis. Secondary keloid is not a tumor but represents a reactive fibrosis. Nevertheless, it cannot be differentiated from a dermatofibroma on a histological basis. In an early keloid one finds a moderate number of fibroblasts. An old keloid may show practically no cellular elements."

A keloid differs from a hypertrophic scar since it involves skin areas beyond the limits of injury.[16] Furthermore, hypertrophic scars contain small collagen fibrils while keloids are composed of large collagen fibrils.[17]

When a wound heals normally, there is a cessation of the formation of fibrous tissue as soon as continuity has become established. However, this is not the case with the formation of keloids, for here the proliferation of fibroblasts continues with a piling-up, as it were, of fibroblasts. The trigger mechanism, which may be responsible for this reaction, may be the leukotaxine of Menkin, as has been mentioned heretofore. This results in the formation of the new growth which is called a keloid. This mass is forced upward from its stromal bed by two major forces, (1) the concomitant edematous states and (2) the ever enlarging neoplasmal growth, so that, at length, this mass pushes through the integument as a herniation of that structure in a manner similar to that of a uterine fibroid and polyp.[18]

Why do keloids develop in certain individuals and races while in others they do not? Obviously many factors are responsible. I shall discuss briefly a few of those etiologic agents which may be involved.

Tissue injury is of prime importance in most pathologic inquiries. Wertheimer and Ward[19] have confirmed Hardy, Goodell and Wolff's hypothesis that a very close relationship exists between tissue damage and pain. Their very recently reported studies support the concept that the adequate stimulus for pain is tissue injury.

In our current consideration as to the trigger mechanism for the growth of keloids I believe that the release of leukotaxine from tissue damage might be the stimulus for the infiltration and the growth of fibroblasts. The leukotaxine is released through the presence of inspissated blood in the tissue stroma. In support of this thesis is the series of experiments which I performed upon myself some years ago. Repeated blood serum injections were administered to the right thigh areas. The thighs were employed to allow for auto-injections. These areas were extirpated after such repeated injections produced experimental localized edema.[20] Upon the extirpation of these tissue areas the experimental skin areas, which received the intracutaneous injections of blood serum, hemorrhaged much more freely than did the tissues from the opposite left thigh, which had received similar repeated intracutaneous injections of physiologic saline solution as the control. Furthermore, the skin areas which received the blood serum exhibited marked fibromatous changes which were totally absent in the skin control areas.

Hence from these interesting observations it appeared that experimental edema, produced by the inspissated blood serum injections in these skin areas, apparently attracted fibroblasts which began laying down connective tissue. The overproduction of the fibrous mass plus the pressure of the edema exerted upward pressure, so that these neoplasms could herniate through the integument if allowed to remain intact for a longer period of time. Upon careful histologic examinations these new tumor masses appeared to be very similar to early keloids. We also found the presence of dilated blood vessels in these keloidal areas. This accounted for the excessive bleeding upon extirpation which was not experienced when the skin areas, which received the saline solution, were removed. From these observations

it was believed that there is a direct relationship between the presence of tissue edema or hemorrhage and the later formation of fibrous (scar) tissue. Furthermore, Schadeberg and I have recorded the presence of a reversed albumin-globulin ratio in a very severe case of keloidosis.[21] The latter condition can produce tissue edema through increased capillary permeability which may lead to severe tissue edema and finally to the piling-up of fibroblasts to produce the so-called spontaneous keloids. Vitamin D deficiency may also cause increased capillary permeability, as has been mentioned heretofore.

Treatment of keloids will not be considered. However, I can state that the new vasoconstrictor substance, kutapressin,* isolated from liver by the author, has given highly satisfactory results to many colleagues who have treated keloids with this material. This apparently can reverse at least partially the blood fluid extravasations which lead to the early formation of keloids and hypertrophic scars.

REFERENCES


1. Marshall, W. Physiological and bacteriological factors in wound healing. *West. J. Surg.*, 51: 24, 1943.
2. Boyd, W. A Textbook of Pathology, p. 130. Philadelphia, 1944. Lea & Febiger.
3. Nutini, L. Physical agents in tissue repair. *Arch. Phys. Therapy*, 23: 285, 1942.
4. Ham, A. W. Histology, p. 169. Philadelphia, 1950. J. B. Lippincott Co.
5. Ibid.[4]
6. Dible, J. H. and Davie. Pathology, p. 28. Philadelphia, 1950. J. B. Lippincott Co.
7. Speidel, W. C. The physical law of repair and the healing of wounds. An original hypothesis. *West. J. Surg.*, 53: 383, 1945.
8. Mason, M. L. Early closure of burn areas. *J. Florida M. A.*, 36: 149, 1949.
9. Rhoades, J. E., Fliegelman, M. T. and Panzer, L. M. The mechanisms of delayed wound healing in the presence of hypoproteinemia. *J. A. M. A.*, 118: 21, 1942.
10. Da Costa, J. E. Modern Surgery, p. 6. Philadelphia, 1943. W. B. Saunders Co.
11. Christopher, F. A Textbook of Surgery, p. 6. Philadelphia, 1943. W. B. Saunders Co.
12. Ibid.[11]
13. Marshall, W. Behavior problems in children caused by vitamin D deficiency. *South Dakota Med. & Pharm.*, 5: 110, 1952.
14. McCarthy, L. Histopathology of Skin Diseases, p. 181. St. Louis, 1931. C. V. Mosby Co.
15. Lever, W. F. Histopathology of the Skin, pp. 355, 356. Philadelphia, 1949. J. B. Lippincott Co.
16. Becker, S. W. and Obermayer, M. E. Modern Dermatology and Syphilology, p. 591. Philadelphia, 1941. J. B. Lippincott Co.
17. Christopher, F.[11]
18. Marshall, W. and Schadeberg, W. A study of keloids and related conditions. *Wisconsin M. J.*, 49: 369, 1950.
19. Wertheimer, M. and Ward, W. D. The influence of skin temperature upon pain threshold evoked by thermal radiation—a confirmation. *Science*, 115: 499, 1952.
20. Marshall, W. Fibromatous skin lesions produced by repeated blood serum injections in the human. *Am. J. Surg.*, 69: 338, 1945.
21. Marshall, W. and Schadeberg, W.[18]


* Kutapressin is manufactured by the Kremers-Urban Company of Milwaukee, Wis.

# POSTOPERATIVE WOUND DISRUPTION*

WILLIAM P. KLEITSCH, M.D. AND DALE W. DOUGLAS, M.D.
*Omaha, Nebraska* *Lincoln, Nebraska*

POSTOPERATIVE wound disruption is generally described as an extremely grave complication with a mortality rate variously reported between 10 and 80 per cent. Our experience does not support this point of view. We believe that a wound disruption is a disagreeable but seldom fatal complication. We believe that deaths following wound disruptions are the result of the continuation and aggravation of factors which caused the wound disruption and are not a result of the disruption *per se*. An unselected series of nineteen cases was reviewed; all occurred in approximately five post-World War II years on an active surgical service. No attempt was made to determine the incidence of wound disruption per case. This study was directed primarily at determining the cause of death following wound disruption and secondarily to stimulate more critical thinking on the subject.

Postoperative wound disruption or evisceration is the inescapable responsibility of the surgeon who made the wound. Usually such a complication implies inadequate preoperative treatment, improper postoperative management and, rarely in good hands, poor surgical technic. Frequently a wound disrupts because of the nature of the disease: Urgent need for operative intervention may preclude satisfactory preoperative preparation of the patient, or drainage of an abscess or perforation of a viscus may result in continuous and unavoidable contamination of the wound. In any case, however, the responsibility is yet the surgeon's, and it behooves him to correct the condition as expeditiously as possible not only to save face but also to expedite the recovery of the patient.

## DIAGNOSIS

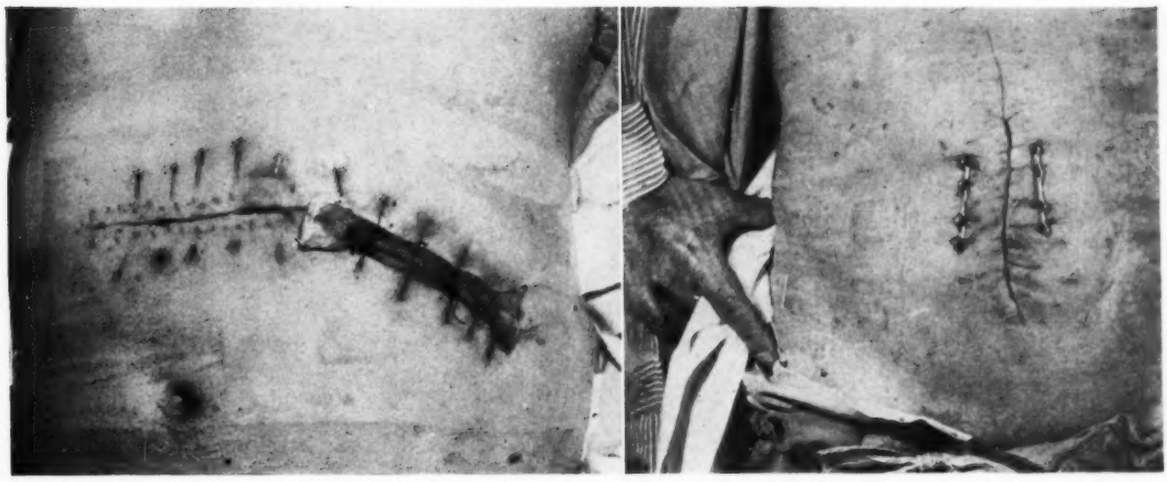
Although the diagnosis of postoperative wound disruption is easy, many are not diagnosed until several days have passed and some not until an actual evisceration occurs. The reasons for delay in diagnosis are twofold. A delayed diagnosis implies (1) that insufficient attention was paid to the postoperative wound at ward rounds or (2) that the significance of the postoperative wound changes were either not appreciated or not accepted by the observer. The last item is of considerable significance since there is a rather pardonable reluctance on the part of a surgeon to admit that the wound he has so carefully sutured has broken open. It is always easier to diagnose a wound disruption in another surgeon's patient.

The pathognomonic sign of postoperative wound disruption is the escape, in varying quantities, of a serosanguineous fluid from the wound. The amount of fluid, the appearance of the wound and the duration of the drainage are not important. It must be appreciated that *serosanguineous fluid staining the dressings of an abdominal wound can come only from the peritoneal cavity*, and therefore implies a peritoneal cutaneous fistula (i.e., wound disruption) with the discharge of peritoneal fluid. This fistula is almost always quickly closed either by adherence of a loop of bowel or of omentum, and the drainage ceases. Cessation of the serosanguineous drainage therefore does not imply closure of the wound disruption. Once a wound has disrupted, it must be treated by suture or else it will invariably result in postoperative herniation. It may therefore be established as a rule that *all wounds which drain serosanguineous fluid in any amount are disrupted wounds and should be opened, explored and resutured.*

## TREATMENT

Treatment of postoperative wound disruption may properly be divided into prophylactic and active. Prophylactic treatment requires most urgently the correction of malnourished states. This implies the correction of malnourishment in its broadest sense. The most important factor to be considered is the restoration

* From the Department of Surgery of the Creighton University School of Medicine and the Surgical Services of the Veterans Hospitals in Omaha and Lincoln, Neb. Sponsored by the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are a result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.



1 2

FIG. 1. Illustrates the use of heavy silk sutures tied over a gauze pad to treat a postoperative wound disruption. Note the excellent healing in the medial half of the wound from which the sutures and pad have been removed; also note that the sutures are snugly tied.

FIG. 2. Demonstration of the use of stainless steel wire and bone plates in the treatment of wound dehiscence due to infection. Note that the patient was ambulant at the time the photograph was taken.

of the protein reserve of the individual. However, the significance of subclinical avitaminosis, especially avitaminosis C, and adequate fluid and electrolyte balance is not to be minimized. The correction of chronic, preoperative anemia is of considerable significance since a chronically anemic patient is usually a malnourished one; therefore, an operation on a chronically anemic patient is an operation on an inadequately prepared surgical patient.

Additional prophylactic measures are indicated to treat as completely as is possible all complications prior to operation. This is especially true of cardiorespiratory complications. Impending cardiac failure, bronchitis and asthma as well as acute upper respiratory infections should all be treated before elective surgery is undertaken. The judicious use of antibiotics is invaluable. Aerosal penicillin inhalations for treatment of upper respiratory infections, and aureomycin and streptomycin in the preparation of the bowel are well established and need not be expanded on at this time. The use of digitalis is usually prescribed in consultation with the internist. However, it may be said that if a question concerning the indication for digitalis exists, it is a safer procedure to administer the drug than to withhold it.

The active treatment of wound disruption is fairly well established as being resuture with non-absorbable through and through sutures as soon as the diagnosis is made. The earlier after the disruption that the wound is resutured, the more quickly will it heal and the more satisfactory will be the subsequent convalescence. This in itself is indication enough for careful observation of all postoperative wounds to detect any suspicion of dehiscence.

The use of adhesive tape strapping of a postoperative wound disruption should not be confused with treatment. It is more properly identified as procrastination. Treatment of wound disruption implies reapproximation of the separated layers of the abdominal wall. This objective cannot be achieved by adhesive tape strapping, which at best can only approximate the skin edges. Permitting the depths of the wound to remain open by merely strapping the skin predisposes to peritonitis, paralytic ileus, abdominal distention, aggravation of the disruption, possible evisceration and certain postoperative herniation.

### TECHNIC OF SUTURE

The technic we favor for the resuture of disrupted abdominal wounds utilizes heavy, noncapillary silk sutures passed through all of the layers of the abdominal wall and tied over a gauze pad. (Fig. 1.) The gauze pad prevents the sutures from cutting in and favors inversion and approximation of the skin edges. The sutures are tied as tightly as possible without consideration of possible ischemia of the wound

3 4

FIG. 3. Failure of the gauze pad and silk suture technic due to the drainage of pus from the wound. Note the abdominal distention due to ileus.

FIG. 4. Substitution of steel wire and bone plate technic; compare with Figure 3. At this time healing was quite advanced and the patient was ambulant.

edges. We believe it is more essential to have the disrupted wound edges in firm apposition, to prevent omentum or bowel from working out between them, than it is to be concerned over possible local necrosis of the wound edges. We have discovered by experience that tightly tied sutures may cut into the tissues but we have never found them to produce wound necrosis or to interfere with healing. The sutures are never removed earlier than the tenth day and often are left in longer. This type of closure is applicable only to wounds which are dry and apparently uninfected.

In draining and infected wounds we prefer to use through and through sutures of a moderately heavy stainless steel wire (about 22 gauge). The sutures are placed through the openings of standard bone plates which serve the purpose of distributing the tension more evenly and thus delay them from cutting in. (Fig. 2.) Wire sutures have a definite advantage in that they are non-capillary and non-irritating. In addition they permit irrigation of the wound and subsequent tightening of the suture if this should be necessary. However, this technic is a second choice because wire sutures and plates are somewhat painful to the patient, and the use of wire sutures is somewhat of a nuisance since it requires a special technic, the wires get caught in dressings, etc. The Davy button and wire suture technic may be used to advantage but this requires special forceps and buttons which are not always available. A selection of bone plates and wire sutures is available in most operating rooms and this technic is used for the sake of convenience as well as effectiveness.

The only anesthesia necessary for the resuture of a disrupted abdominal wound is local infiltration of 1 per cent procaine solution. This anesthetic solution is injected subcutaneously and retroperitoneally. Satisfactory anesthesia is always obtainable. An intercostal block may be used to supplement local infiltration if desired. General or spinal anesthesia has never been found to be necessary.

## CLINICAL STUDY

An unselected group of nineteen wound disruptions was reviewed for this study. The youngest patient in the group was twenty-five years of age and the oldest was seventy. The cases were divided into three groups. The first group consisted of nine wound disruptions which healed promptly after secondary suture. The next group consisted of seven cases which required two or more secondary closures before final healing was achieved. The last group, of three cases, were those patients who died after postoperative wound disruption had occurred.

*Group I.* This series of nine patients all had healing promptly after the wound had been resutured. Recovery was prompt and uneventful, and no particular problems were encountered in this group. The cause of the disruption in some of these cases was difficult to determine. In two cases wound infection was the obvious cause of the disruption. The rest

of the cases have a common factor in that they all involved serious pathologic conditions of the gastrointestinal tract, with the exception of one which occurred in a young man so seriously and chronically ill with interstitial cystitis that his nutritional state approached that of chronic gastrointestinal disease.

*Group II.* These seven cases all required more than one secondary closure before final healing of the wound disruption occurred. With the exception of one case all these patients had a wound infection which contributed either to the first or second resuture. In another instance the patient had an extremely complicated postoperative course which developed when an appendectomy was performed for unsuspected amebic appendicitis. This case has previously been reported in detail.[5] Another patient was a chronic alcoholic with advanced neurologic findings of peripheral neuritis. He had a low protein reserve which was discovered by the fact that the albumin-globulin ratio, which was normal prior to the operation, reversed itself postoperatively. Postoperative bronchitis was an additional factor. Another serious wound disruption developed following an appendectomy with generalized peritonitis, which resulted in abundant purulent drainage through the wound postoperatively. (Figs. 3 and 4.) In another patient a wound infection and separation developed following incision and drainage of an abdominal abscess secondary to the perforation of carcinoma of the sigmoid. A serious problem was encountered in one case when wound disruption developed as a result of postoperative cardiac failure further complicated by dyspnea and cardiac asthma. Following the wound disruption an infection developed which led to a subphrenic abscess and a second wound disruption which healed after the abscess was drained and the cardiac failure was corrected. (Fig. 5.) The last case in this group represented a complicated nutritional and electrolyte problem which developed following colectomy but which responded to intensive supportive measures.

*Group III.* These three patients died following wound disruption and represent approximately a 16 per cent mortality. In no case, however, was it possible to indict the wound disruption *per se* as a cause of, or even a contributing factor in, their deaths. It is more likely that the wound disruption in each case represented an expression of the failure of the healing process in patients with difficult postoperative problems. The first case was an extremely complicated problem in that the man had had a massive hemorrhage from an esophageal hiatus hernia which required more than 3,000 cc. of blood to be administered within twenty-four hours on the day of operation. He died eleven days after the wound disruption and twenty days after his operation, of multiple pulmonary emboli. At the time of his death the wound disruption had almost healed and he was considered to be out of danger. There is no reason to believe that the pulmonary embolism was a result of the wound disruption since the patient had been ambulant for two or three days prior to the fatal episode. The second case was that of a wound disruption which occurred after cholecystectomy in a patient in whom cardiac failure developed. The cardiac failure and the resulting dyspnea were thought to be factors in the wound disruption, and not the wound disruption a factor in the cardiac failure since the failure preceded the disruption. Death followed because of inability to control the heart failure. The last case was that of a patient who died of necrotizing pancreatitis following subtotal gastrectomy. Death was obviously due to overwhelming toxemia which resulted from the necrotizing pancreatitis. The wound disruption was thought to be an incident in this process, being secondary

FIG. 5. Bone plate and wire technic for a disrupted and infected wound of the right upper quadrant. The cutting in of the plates was at least partially aggravated by a pyocyaneus infection. The patient at this time was up and about in a wheelchair.

to the generalized peritonitis which accompanied the pancreatitis.

## COMMENTS

In the evaluation of the causes of postoperative wound disruption it seems important to avoid repeating the clichés so often utilized when this subject is discussed. This is particularly true concerning the significance of local precipitating factors. With the exception of wound infections local factors can be dismissed from consideration as a basic cause of wound disruptions. Mechanical strain such as coughs, sneezes and vomiting, although of undoubted significance in precipitating the disruption of a postoperative wound, can hardly be considered to be the basic cause of such disruptions (except in rare instances) since mechanical strain does not usually produce wound disruption. A normally healing wound will resist mechanical strain of surprising degrees. It is important, therefore, to determine why a certain strain will cause one wound to disrupt and not another. The obvious although vague answer is that there is an interference in the normal healing process in wounds which disrupt. The most important deficiency in this respect is undoubtedly that of an inadequate protein reserve. In spite of the crude methods available for measuring protein reserve an extremely high percentage of patients whose wounds disrupt will show a diminished serum protein level and many of them will actually have a reversal of the albumin-globulin ratio. It is our opinion that in the absence of wound infections the most important factor in postoperative wound disruptions is an inadequate protein reserve. This implies that in patients who have wound disruptions the normal postoperative catabolism is inordinately prolonged. Since it is extremely difficult to treat this condition postoperatively, especially if oral feedings are restricted, it indicates the importance of adequate nutritional preparation of patients who require major surgery. Heart failure in a well nourished patient, unless recognized and promptly treated, will also result in failure of wounds to heal because of the consequent circulatory disturbance.

When the depths of a disrupted wound are examined, one usually finds the buried, nonabsorbable sutures intact, indicating that the disruption occurred as a result of tissue failure rather than inadequate strength of suture material. This is further supported by the finding in a large series of cases that the use of non-absorbable sutures does not reduce the incidence of wound disruptions.[4,7]

If one accepts the hypothesis that wound disruption is a local manifestation of a constitutional deficiency, it explains why so many patients die after what appears to be a minor tragedy in convalescence. If the constitutional disorder is reversible, the patient will survive. If the constitutional disturbance is not reversible or if the disruption contributes to making it an irreversible process, the patient dies. The death, however, is due to the constitutional disorder and not to the local factor of wound separation.[6] This concept suggests that the most intensive efforts be directed at treating the constitutional disorder and the treatment of the disruption be pursued primarily as an adjunct to the constitutional treatment. That is, the wound disruption should be eliminated not because it in itself is a hazard but because it may be the deciding factor in producing an irreversible trend in a constitutional disorder. Thus a disrupted wound which is unsutured may readily result in mild peritonitis, ileus and all of the serious implications relative to maintenance of adequate fluid, electrolyte and protein balance. This additional load upon an already inadequate protein reserve or failing myocardium may tilt the balance in the wrong direction.

The relative unimportance of local factors in mortality from wound disruptions is indicated by the fact that all of the patients with seriously infected disruptions in this series survived, despite prolonged and difficult convalescence. They survived even multiple disruptions. The fatal cases, on the other hand, were all deaths of other than local causes, in wounds which were apparently uninfected and adequately sutured. For the treatment of wound disruption, early and adequate suture is recommended and the operation should not be considered as having a mortality rate. The wounds of all but moribund patients may be sutured with local anesthesia without danger. The operation is of nuisance significance—not dangerous.

## SUMMARY

Postoperative wound disruptions are usually local manifestations of a generalized failure of the healing process. Local factors, with the

exception of infection, are rarely of great significance. Mechanical strains may play a precipitating role in the etiology of a disruption but only seldom are they the basic cause. Deaths following wound disruptions are due to factors other than the disrupted wound.

REFERENCES

1. Crile, G. Jr. and Shively, F. L. Hospital Care of the Surgical Patient, pp. 50–53. Springfield, Ill., Charles C Thomas.
2. Fallis, L. S. The management of postoperative wound separation. *Surgery*, 9: 198–203, 1941.
3. Hesseltine, H. C. and Bohlender, G. P. Closure and subsequent care of obstetric and gynecologic abdominal wound disruption. *Surgery*, 9: 40–50, 1941.
4. Joergenson, E. J. and Smith, E. T. Postoperative abdominal wound separation and evisceration. *Am. J. Surg.*, 79: 282–287, 1950.
5. Kleitsch, W. P. and Kisner, P. Amebic appendicitis, peritonitis and wound infection. *Ann. Surg.*, 133:139–142, 1951.
6. Landry, B. B., Nolan, J. O. and Burns, J. E. Wound rupture. *Am. J. Surg.*, 79: 787–792, 1950.
7. Wolff, W. I. Disruption of abdominal wounds. *Ann. Surg.*, 131: 534–555, 1950.

The administration (local and systemic) of bacitracin has proved of exceptional value in the treatment of surgical infections. According to Meleney et al., who used this antibiotic in a large series of cases, bacitracin medications were successful in over 70 per cent of the patients previously treated by other antibiotics without benefit; and if bacitracin was the first and only antibiotic used, successful results can be anticipated in over 90 per cent. This medication is relatively atoxic. Of course it is still wise to test the organisms found in surgical infections against the various antibiotics because occasionally these tests will show that the administration of a combination of antibiotics, and not just one, is indicated. (*Richard A. Leonardo, M.D.*)

# REDUCTION OF PAIN AND MORBIDITY IN ANORECTAL SURGERY WITH THALAMYD

LOUIS SEGAL, M.D.
*Brooklyn, New York*

REPORT is made of 100 patients with various anorectal conditions on whom surgery was performed. It was the objective in this study to reduce postoperative pain and postoperative morbidity. With this objective in mind we prepared each patient preoperatively with phthalylsulfacetamide (thalamyd®).* Therapy was continued postoperatively to prevent infection of the incision by bacteria-laden feces.

Thalamyd is a non-absorbable sulfonamide with a very low order of toxicity.[1] It is especially effective in treating enteric infections and has been shown to sterilize the bowel.[2] Lack of contamination of the surgical incision, with subsequent infection, results in marked reduction in postoperative pain and morbidity. Other investigators have attempted to achieve this objective by use of various anesthetic agents dissolved in oily media injected around the anal margin. This method frequently results in pain-free intervals varying from one to three weeks. However, sterile abscesses occur which require incision and drainage and there is always the possibility of reinfection.

In this series the most frequent indication for operation was internal or external hemorrhoids. In a number of cases the presence of additional pathologic conditions required fistulectomy, fissurectomy, polypectomy and papillectomy, as well as hemorrhoidectomy. (Table I.)

Patients in this series were treated with thalamyd, diet and sitz baths. Thalamyd was given in 1 gm. doses four times daily for two days preoperatively and for two or three weeks postoperatively. Dosage was then reduced to 0.5 gm. four times daily until complete healing had occurred. In the presence of an acute infection of the anorectal region chloromycetin was prescribed in addition to thalamyd. Surgery was not performed on any patient until infection was controlled.

* Phthalylsulfacetamide (thalamyd) was supplied through the courtesy of Schering Corporation, Bloomfield, N. J.

Diet maintained by the patients for three to six months postoperatively was as follows:

Mineral Oil:
One tablespoonful one hour after each meal, three times a day
Choice of Foods:
Cooked cereal, milk desserts
Jello, clear jelly
Farmer cheese, pot cheese
Stale bread or rolls; if fresh, toast
Stale Danish cake
Boiled or poached eggs
Beef in any form, except no fat, not fried, no gravy
White meat of fowl
Broiled or boiled cod, halibut, yellow pike or filet of flounder
Fresh fruit, peeled
Tea, Postum, cocoa or milk
A multiple vitamin capsule once a day was advised.

Purpose of dietary regulation before and after surgery was to lessen the amount of gas formation with its resultant discomfort. This diet reduces to a minimum the fecal volume during the postoperative period. Mineral oil prevented hard stools and helped tissue regain its normal elasticity. Baths in lukewarm water were prescribed at least three times daily. Patients were instructed to massage the anorectal rim with Ivory soap. During the interval between baths, local boric acid compresses were applied and directions for proper bowel hygiene provided.

The usual surgical technic was employed. In fistulectomy radical removal of tissue was performed. Healing time depended on the extensiveness of surgery required and condition of the tissue prior to operation. Healing, with complete continuity of tissue, was effected in intervals of time ranging from seventeen to forty-seven days; average 28 days. This represents a definite reduction when compared with

healing time in similar procedures observed prior to use of thalamyd.

Postoperatively patients were much more comfortable, more active and required less medication for relief of pain than patients who had not received thalamyd. In Table II the amount of postoperative sedation is recorded. In those cases in which demerol was required during the first day, pain was frequently the result of pressure symptoms from the bladder rather than from the excised area. Routine medication usually employed consisted of a capsule containing codeine gr. ¼, phenobarbital gr. ¼ and aspirin gr. III, referred to as "CPA." Twelve patients required no medication of any nature, not even aspirin; four others received one "CPA" capsule. Thirty-one patients required no medication of any kind after the first postoperative day. An additional twenty-two patients received no medication after the second postoperative day; twenty-three required no medication after the third postoperative day.

Our series included fifty-nine males and forty-one females whose ages varied from twenty-two to seventy-one years; average 44.8 years. Anesthesia consisted of one local, twenty-nine caudals and seventy low spinals. Average hospital stay was five days. Initial dilatation following surgery was performed on an average of five to seven days postoperatively. Vaseline gauze wrapped in oxycel was inserted into the anal canal for forty-eight hours postoperatively or until the first bowel movement. An enema was administered at the end of the first forty-eight hours. Subsequent bowel movements were much more comfortable. There were no complications.

The incidence of pain and the vitality of tissue are inseparably linked with the presence of infection. In order to reduce postoperative pain and morbidity it is necessary to reduce the degree of infection both pre- and postoperatively. In the past various antibiotics and chemotherapeutics have been employed. The use of absorbable sulfonamides occasionally gives rise to undesirable side actions, including agranulocytosis and crystalluria. Use of others of the non-absorbable sulfonamides has resulted in diarrhea. Aureomycin and terramycin, while effective against many of the intestinal bacteria, have similarly resulted in diarrhea. Proctoscopic examinations subsequent to the use of these antibiotics have revealed numerous areas which were red and ulcerated presenting a picture not unlike ulcerative proctitis. Proctoscopic examination subsequent to the use of thalamyd showed normal mucosa.

It has been shown by Henderson and Seneca[2] that thalamyd provides effective sterilization of the human gut and reduction of the intestinal flora. It was possible in their study to reduce the total number of organisms to 10,000 per gm. of wet feces and the coliform bacteria to zero, effectively sterilizing the gut before surgery. A bacterial count of this magnitude is well within the limits acceptable for pasteurized milk.

TABLE I

| Type of Operation | No. of Cases |
|---|---|
| Hemorrhoidectomy | 40 |
| Hemorrhoidectomy, fissurectomy | 10 |
| Hemorrhoidectomy, fistulectomy | 8 |
| Hemorrhoidectomy, polypectomy | 8 |
| Hemorrhoidectomy, fistulectomy, fissurectomy | 7 |
| Hemorrhoidectomy, fissurectomy, polypectomy | 7 |
| Hemorrhoidectomy, papillectomy | 6 |
| Hemorrhoidectomy, fistulectomy, polypectomy | 2 |
| Hemorrhoidectomy, fistulectomy, fissurectomy, papillectomy | 2 |
| Fistulectomy, excision of abscess cavity | 2 |
| Hemorrhoidectomy, polypectomy, papillectomy | 1 |
| Hemorrhoidectomy, polypectomy, internal proctotomy | 1 |
| Hemorrhoidectomy, external proctotomy | 1 |
| Hemorrhoidectomy, fissurectomy, papillectomy | 1 |
| Hemorrhoidectomy, fistulectomy, papillectomy | 1 |
| Hemorrhoidectomy, fistulectomy, polypectomy, papillectomy | 1 |
| Hemorrhoidectomy, papillectomy, anoplasty | 1 |
| Fistulectomy, fissurectomy | 1 |

Thalamyd is an active bactericidal agent which is absorbed into intestinal wall from the mucosa through to the serosa in high concentrations.[2–4] It is not absorbed into the blood stream.[2] Its non-absorption obviates the urinary tract complications which sometimes occur with absorbable sulfonamides.

## SUMMARY

1. In our hands thalamyd has been a versatile agent for use in proctology.

2. Postoperative healing time following anorectal surgery has been reduced at least 20 per cent subsequent to the use of thalamyd.

3. No postoperative infections have occurred in any patients following use of thalamyd. There have been no allergic reactions nor any complications of any kind as a result of therapy with thalamyd.

TABLE II

| Case No. | Sex and Age | Operation | Anesthesia | Postoperative Sedation | | | | Hospital | | Healing with Complete Continuity of Tissue (Days) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1st Day | 2nd Day | 3rd Day | 4th Day | Admission | Discharge | | |
| 1 | M, 46 | Hemorrhoidectomy | Low spinal | CPA* cap 1† | CPA cap 1 | CPA cap 1 | 0 | 5/10/50 | 5/15/50 | 35 | Dilatation 6 days PO‡ |
| 2 | M, 45 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. | CPA cap 1 | 0 | 0 | 5/16/50 | 5/21/50 | 35 | Dilatation 5 days PO |
| 3 | F, 71 | Fistulectomy, hemorrhoidectomy | Caudal | 0 | 0 | 0 | 0 | 5/7/50 | 5/14/50 | 35 | Dilatation 7 days PO |
| 4 | F, 33 | Fissurectomy, polypectomy, hemorrhoidectomy | Caudal | 0 | CPA cap 1 | 0 | 0 | 5/14/50 | 5/19/50 | 31 | Dilatation 7 days PO |
| 5 | M, 49 | Fissurectomy, fistulectomy, hemorrhoidectomy | Low spinal | Demerol 100 mg. | 0 | 0 | 0 | 5/16/50 | 5/25/50 | 30 | Dilatation 6 days PO |
| 6 | F, 46 | Fistulectomy, hemorrhoidectomy | Caudal | Demerol 100 mg. t.i.d. | CPA cap 1 t.i.d. | CPA cap 1 b.i.d. | 0 | 5/19/50 | 5/23/50 | 26 | Dilatation 6 days PO |
| 7 | M, 37 | Fissurectomy, hemorrhoidectomy | Caudal | Demerol 100 mg. b.i.d. | CPA cap 1 b.i.d. | CPA cap 1 | CPA cap 1 | 6/11/50 | 6/16/50 | 29 | Dilatation 7 days PO |
| 8 | M, 60 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. | CPA cap 1 | CPA cap 1 | 0 | 7/7/50 | 7/13/50 | 32 | Dilatation 6 days PO |
| 9 | M, 22 | Hemorrhoidectomy, papillectomy | Low spinal | Demerol 100 mg. b.i.d. | CPA cap 1 | 0 | 0 | 7/7/50 | 7/12/50 | 32 | Dilatation 6 days PO |
| 10 | M, 30 | Fistulectomy, hemorrhoidectomy | Low spinal | Demerol 100 mg. | CPA cap 1 | 0 | 0 | 7/10/50 | 7/14/50 | 41 | Dilatation 6 days PO |
| 11 | M, 34 | Hemorrhoidectomy | Low spinal | 0 | 0 | 0 | 0 | 7/12/50 | 7/16/50 | 27 | Dilatation 5 days PO |
| 12 | F, 31 | Hemorrhoidectomy, polypectomy | Local anesthesia | CPA cap 1 | 0 | 0 | 0 | 7/12/50 | 7/16/50 | 33 | Dilatation 6 days PO |
| 13 | F, 40 | Fistulectomy, hemorrhoidectomy | Caudal | Demerol 100 mg. t.i.d. | CPA cap 1 t.i.d. | CPA cap 1 | CPA cap 1 | 7/14/50 | 7/19/50 | 36 | Dilatation 6 days PO |
| 14 | M, 42 | Hemorrhoidectomy | Caudal | Demerol 100 mg. | 0 | 0 | 0 | 7/18/50 | 7/22/50 | 33 | Dilatation 7 days PO |
| 15 | M, 49 | Fissurectomy, fistulectomy, hemorrhoidectomy | Caudal | Demerol 100 mg. | CPA cap 1 | CPA cap 1 | 0 | 7/23/50 | 7/29/50 | 37 | Dilatation 7 days PO |
| 16 | F, 45 | Hemorrhoidectomy | Caudal | Demerol 100 mg. b.i.d. | 0 | CPA cap 1 | 0 | 7/25/50 | 7/29/50 | 22 | Dilatation 5 days PO |
| 17 | M, 46 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. CPA cap 1 | CPA cap 1 t.i.d. | CPA cap 1 b.i.d. | CPA cap 1 | 7/28/50 | 8/2/50 | 23 | Dilatation 6 days PO |
| 18 | F, 42 | Hemorrhoidectomy, polypectomy, internal proctotomy | Caudal | Demerol 100 mg. b.i.d. | CPA cap 1 | 0 | 0 | 7/31/50 | 8/5/50 | 40 | Dilatation 7 days PO |
| 19 | M, 42 | Fissurectomy, hemorrhoidectomy | Caudal | Demerol 100 mg. | 0 | 0 | 0 | 8/8/50 | 8/14/50 | 26 | Dilatation 7 days PO |
| 20 | F, 41 | Fistulectomy, hemorrhoidectomy | Low spinal | Demerol 100 mg. b.i.d. | CPA cap 1 b.i.d. | CPA cap 1 | CPA cap 1 | 8/8/50 | 8/13/50 | 39 | Dilatation 5 days PO |
| 21 | M, 43 | Fissurectomy, hemorrhoidectomy | Low spinal | Demerol 100 mg. b.i.d. | CPA cap 1 | CPA cap 1 | 0 | 8/9/50 | 8/13/50 | 31 | Dilatation 4 days PO |
| 22 | M, 50 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. b.i.d. | CPA cap 1 b.i.d. | CPA cap 1 | 0 | 8/10/50 | 8/14/50 | 26 | Dilatation 5 days PO; this patient had an infection with edema which was treated prior to surgery to avoid PO complications |
| 23 | M, 52 | Hemorrhoidectomy, papillectomy, polypectomy | Low spinal | 0 | 0 | 0 | 0 | 8/22/50 | 8/26/50 | 28 | Dilatation 6 days PO; preoperative treatment for infection |
| 24 | M, 40 | Fissurectomy, hemorrhoidectomy | Caudal | Demerol 100 mg. b.i.d. | CPA cap 1 b.i.d. | CPA cap 1 | CPA cap 1 | 8/21/50 | 8/30/50 | 28 | Dilatation 5 days PO; apprehensive, developed physiologic ileus |
| 25 | M, 50 | Hemorrhoidectomy | Caudal | Pantopon gr. 1/6 b.i.d. | 0 | 0 | 0 | 8/30/50 | 9/3/50 | 21 | Dilatation 6 days PO |
| 26 | F, 66 | External proctotomy, hemorrhoidectomy | Caudal | Demerol 100 mg. | 0 | 0 | 0 | 9/13/50 | 9/19/50 | 21 | Dilatation 8 days PO; fecal impaction could not be removed without an external proctotomy |

* CPA = Phenobarbital gr. 1/4, Codeine gr. 1/4, Aspirin gr. 5

† Cap 1. Every 4 hours as needed

‡ PO = Postoperative

Note: Where infection and edema are severe, chloromycetin 250 mg. every 6 hours for 96 hours

TABLE II (*Continued*)

| Case No. | Sex and Age | Operation | Anesthesia | Postoperative Sedation | | | | Hospital | | Healing with Complete Continuity of Tissue (Days) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1st Day | 2nd Day | 3rd Day | 4th Day | Admission | Discharge | | |
| 27 | F, 50 | Fistulectomy, hemorrhoidectomy | Low spinal | Demerol 100 mg. b.i.d. | CPA cap 1 | 0 | 0 | 9/22/50 | 9/28/50 | 29 | Dilatation 6 days PO |
| 28 | M, 29 | Hemorrhoidectomy | Low spinal | 0 | 0 | 0 | 0 | 9/25/50 | 9/30/50 | 20 | Dilatation 6 days PO |
| 29 | F, 31 | Hemorrhoidectomy, papillectomy | Low spinal | Demerol 100 mg. b.i.d. | CPA cap 1 b.i.d. | CPA cap 1 b.i.d. | CPA cap 1 b.i.d. | 9/25/50 | 10/1/50 | 29 | Dilatation 6 days PO |
| 30 | F, 41 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. t.i.d. | CPA cap 1 b.i.d. | CPA cap 1 | 0 | 10/11/50 | 10/15/50 | 25 | Dilatation 5 days PO |
| 31 | M, 60 | Fissurectomy, hemorrhoidectomy | Low spinal | Demerol 100 mg. | CPA cap 1 b.i.d. | CPA cap 1 | 0 | 10/11/50 | 10/15/50 | 39 | Dilatation 6 days PO |
| 32 | F, 43 | Hemorrhoidectomy | Caudal | Demerol 100 mg. t.i.d. | CPA cap 1 | CPA cap 1 b.i.d. | CPA cap 1 | 10/17/50 | 10/25/50 | 29 | Dilatation 7 days PO |
| 33 | M, 25 | Fistulectomy, fissurectomy, hemorrhoidectomy | Caudal | Demerol 100 mg. t.i.d. | CPA cap 1 | CPA cap 1 | CPA cap 1 | 7/16/50 | 7/21/50 | 31 | Dilatation 7 days PO; this patient had a fissure-in-ano 5 months prior to abscess formation and refused surgery |
| 34 | M, 56 | Hemorrhoidectomy, polypectomy | Caudal | Demerol 100 mg. | CPA cap 1 b.i.d. | CPA cap 1 | CPA cap 1 | 5/16/51 | 5/23/51 | 26 | Dilatation 6 days PO in hospital; operation was postponed 18 days to allow infection and edema to subside |
| 35 | M, 50 | Fissurectomy, fistulectomy papillectomy, hemorrhoidectomy | Low spinal | Pantopon gr. 1/6 b.i.d. | CPA cap 1 | 0 | 0 | 11/10/50 | 11/13/50 | 30 | Dilatation 4 days PO |
| 36 | F, 41 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. | CPA cap 1 | CPA cap 1 | 0 | 11/24/50 | 11/30/50 | 19 | Dilatation 5 days PO; this patient had a severe anorectal infection with edema; 8 days elapsed before surgery was attempted |
| 37 | F, 47 | Hemorrhoidectomy, papillectomy | Low spinal | Demerol 100 mg. | CPA cap 1 | 0 | 0 | 12/4/50 | 12/8/50 | 16 | Dilatation 6 days PO |
| 38 | F, 53 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. b.i.d. | 0 | 0 | 0 | 12/18/50 | 12/28/50 | 29 | Dilatation 6 days PO; chemotherapy with thalamyd 6 days prior to admission |
| 39 | F, 40 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. t.i.d. | CPA cap 1 t.i.d. | 0 | 0 | 12/19/50 | 12/23/50 | 26 | Dilatation 5 days PO |
| 40 | F, 67 | Hemorrhoidectomy | Low spinal | Demerol 50 mg. | 0 | 0 | 0 | 12/25/50 | 1/6/51 | 23 | Dilatation 5 days PO at hospital |
| 41 | M, 33 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. t.i.d. | CPA cap 1 t.i.d. | CPA cap 1 t.i.d. | 0 | 1/1/51 | 1/11/51 | 20 | Dilatation 5 days PO |
| 42 | F, 35 | Hemorrhoidectomy papillectomy | Low spinal | 0 | 0 | 0 | 0 | 1/9/51 | 1/14/51 | 21 | Dilatation 5 days PO |
| 43 | F, 41 | Fissurectomy, hemorrhoidectomy | Low spinal | Demerol 100 mg. t.i.d. | CPA cap 1 t.i.d. | 0 | 0 | 1/15/51 | 1/21/51 | 23 | Dilatation 6 days PO; chemotherapy 2 weeks prior to surgery because of infection |
| 44 | M, 57 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. | 0 | 0 | 0 | 1/26/51 | 1/31/51 | 24 | Dilatation 6 days PO |
| 45 | F, 27 | Hemorrhoidectomy, polypectomy | Low spinal | Demerol 100 mg. t.i.d. | CPA cap 1 t.i.d. | CPA cap 1 | 0 | 2/19/51 | 2/25/51 | 26 | Dilatation 7 days PO |
| 46 | M, 51 | Fistulectomy, polypectomy, hemorrhoidectomy | Low spinal | Demerol 100 mg. | CPA cap 1 | 0 | 0 | 3/7/51 | 3/12/51 | 32 | Dilatation 5 days PO |
| 47 | F, 46 | Fissurectomy, fistulectomy, hemorrhoidectomy | Low spinal | Demerol 100 mg. | 0 | 0 | 0 | 3/9/51 | 3/17/51 | 33 | Dilatation 5 days PO |
| 48 | M, 56 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. b.i.d. | CPA cap 1 b.i.d. | CPA cap 1 | 0 | 3/7/51 | 3/17/51 | 32 | Dilatation 5 days PO |
| 49 | M, 49 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. b.i.d. | CPA cap 1 | CPA cap 1 | 0 | 3/18/51 | 3/23/51 | 28 | Dilatation 7 days PO |
| 50 | M, 57 | Fistulectomy, fissurectomy | Low spinal | 0 | 0 | 0 | 0 | 3/20/51 | 3/24/51 | 47 | Dilatation 6 days PO; this patient had severe infection with abscess formation when surgery was done |

TABLE II (*Continued*)

| Case No. | Sex and Age | Operation | Anesthesia | Postoperative Sedation | | | | Hospital | | Healing with Complete Continuity of Tissue (Days) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1st Day | 2nd Day | 3rd Day | 4th Day | Admission | Discharge | | |
| 51 | M, 56 | Hemorrhoidectomy | Low spinal | 0 | 0 | 0 | 0 | 3/26/51 | 3/31/51 | 20 | Dilatation 6 days PO; chemotherapy and sitz baths 6 days prior to surgery to reduce infection |
| 52 | M, 55 | Fissurectomy, polypectomy, hemorrhoidectomy | Low spinal | Demerol 100 mg. b.i.d. | CPA cap 1 b.i.d. | 0 | 0 | 3/26/51 | 3/31/51 | 22 | Dilatation 6 days PO |
| 53 | M, 62 | Fissurectomy, fistulectomy, hemorrhoidectomy | Low spinal | Demerol 100 mg. | CPA cap 1 t.i.d. | CPA cap 1 b.i.d. | 0 | 3/30/51 | 4/4/51 | 31 | Dilatation 6 days PO; chemotherapy 7 days prior to surgery to reduce infection |
| 54 | F, 49 | Fistulectomy, hemorrhoidectomy | Low spinal | Demerol 100 mg. | 0 | 0 | 0 | 4/5/51 | 4/10/51 | 30 | Dilatation 5 days PO |
| 55 | M, 43 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. b.i.d. | CPA cap 1 | CPA cap 1 | 0 | 4/6/51 | 4/14/51 | 26 | Dilatation 5 days PO |
| 56 | M, 40 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. | 0 | 0 | 0 | 4/9/51 | 4/14/51 | 22 | Dilatation 6 days PO |
| 57 | M, 45 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. b.i.d. | CPA cap 1 b.i.d. | CPA cap 1 b.i.d. | 0 | 4/16/51 | 4/20/51 | 27 | Dilatation 6 days PO |
| 58 | F, 34 | Hemorrhoidectomy | Low spinal | 0 | 0 | 0 | 0 | 5/8/51 | 5/15/51 | 26 | Dilatation 6 days PO |
| 59 | M, 26 | Fissurectomy, hemorrhoidectomy, polypectomy | Low spinal | Demerol 100 mg. t.i.d. | CPA cap 1 | 0 | 0 | 5/14/51 | 5/19/51 | 27 | Dilatation 6 days PO |
| 60 | F, 45 | Fissurectomy, fistulectomy, hemorrhoidectomy | Caudal | Demerol 100 mg. | CPA cap 1 b.i.d. | CPA cap 1 | 0 | 5/15/51 | 5/23/51 | 33 | Dilatation 5 days PO; chemotherapy for 7 days prior to surgery |
| 61 | M, 68 | Hemorrhoidectomy, polypectomy | Low spinal | Demerol 100 mg. b.i.d. | CPA cap 1 b.i.d. | CPA cap 1 b.i.d. | 0 | 11/1/50 | 11/11/50 | 24 | Dilatation 5 days PO |
| 62 | F, 58 | Hemorrhoidectomy, polypectomy | Low spinal | Demerol 100 mg. | CPA cap 1 | 0 | 0 | 5/17/51 | 5/23/51 | 34 | Dilatation 7 days PO |
| 63 | M, 49 | Fistulectomy, polypectomy, papillectomy, hemorrhoidectomy | Low spinal | Demerol 100 mg. b.i.d. | CPA cap 1 b.i.d. | 0 | 0 | 12/27/50 | 1/1/51 | 28 | Dilatation 5 days PO |
| 64 | M, 31 | Hemorrhoidectomy, fissurectomy | Low spinal | 0 | 0 | 0 | 0 | 5/21/51 | 5/26/51 | 27 | Dilatation 6 days PO |
| 65 | F, 46 | Papillectomy, hemorrhoidectomy, anoplasty | Caudal | Demerol 100 mg. | 0 | 0 | 0 | 5/23/51 | 5/28/51 | 46 | Dilatation 6 days PO; anoplasty for anal stenosis |
| 66 | F, 33 | Fissurectomy, hemorrhoidectomy, polypectomy | Low spinal | Demerol 100 mg. | 0 | 0 | 0 | 5/28/51 | 6/2/51 | 28 | Dilatation 6 days PO |
| 67 | F, 45 | Hemorrhoidectomy, fissurectomy, papillectomy, fistulectomy | Low spinal | Demerol 100 mg. t.i.d. | CPA cap 1 t.i.d. | CPA cap 1 t.i.d. | CPA cap 1 t.i.d. | 6/10/51 | 6/15/51 | 28 | Dilatation 6 days PO |
| 68 | M, 45 | Hemorrhoidectomy | Caudal | Demerol 100 mg. | CPA cap 1 | CPA cap 1 | CPA cap 1 | 6/18/51 | 6/25/51 | 20 | Dilatation 6 days PO |
| 69 | M, 41 | Hemorrhoidectomy, polypectomy | Low spinal | Demerol 100 mg. b.i.d. | CPA cap 1 | CPA cap 1 | 0 | 5/15/51 | 5/20/51 | 27 | Dilatation 5 days PO |
| 70 | M, 33 | Hemorrhoidectomy | Caudal | Demerol 100 mg. t.i.d. | CPA cap 1 | CPA cap 1 | 0 | 6/20/51 | 6/25/51 | 25 | Dilatation 6 days PO |
| 71 | M, 36 | Fissurectomy, fistulectomy, hemorrhoidectomy | Low spinal | Demerol 100 mg. t.i.d. | CPA cap 1 t.i.d. | 0 | 0 | 7/13/51 | 7/18/51 | 23 | Dilatation 6 days PO |
| 72 | F, 43 | Hemorrhoidectomy, fissurectomy, polypectomy | Low spinal | Demerol 100 mg. t.i.d. | CPA cap 1 | 0 | 0 | 7/12/51 | 7/18/51 | 34 | Dilatation 7 days PO |
| 73 | M, 61 | Hemorrhoidectomy, polypectomy | Caudal | Demerol 100 mg. | 0 | 0 | 0 | 7/17/51 | 7/23/51 | 40 | Dilatation 7 days PO |
| 74 | F, 41 | Fistulectomy, hemorrhoidectomy, polypectomies | Low spinal | 0 | 0 | 0 | 0 | 8/5/51 | 8/31/51 | 28 | Dilatation 4 days PO |
| 75 | M, 33 | Fistulectomy, excision of abscess cavity | Low spinal | CPA cap 1 | 0 | 0 | 0 | 7/18/51 | 7/23/51 | 40 | Dilatation 6 days PO |
| 76 | M, 25 | Hemorrhoidectomy, papillectomy | Caudal | Demerol 100 mg. | 0 | 0 | 0 | 8/6/51 | 8/14/51 | 24 | Dilatation 5 days PO |
| 77 | M, 61 | Hemorrhoidectomy | Low spinal | 0 | CPA cap 1 | 0 | 0 | 8/31/51 | 9/4/51 | 24 | Dilatation 6 days PO |
| 78 | F, 50 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. b.i.d. | CPA cap 1 | 0 | 0 | 9/7/51 | 9/11/51 | 18 | Dilatation 7 days PO |
| 79 | M, 44 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. | 0 | 0 | 0 | 8/5/51 | 8/15/51 | 28 | Dilatation 5 days PO |

TABLE II (*Continued*)

| Case No. | Sex and Age | Operation | Anesthesia | Postoperative Sedation | | | | Hospital | | Healing with Complete Continuity of Tissue (Days) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1st Day | 2nd Day | 3rd Day | 4th Day | Admission | Discharge | | |
| 80 | M, 62 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. | 0 | 0 | 0 | 9/5/51 | 9/9/51 | 18 | Dilatation 6 days PO |
| 81 | M, 48 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. | CPA cap 1 | 0 | 0 | 9/9/51 | 9/17/51 | 22 | Dilatation 5 days PO |
| 82 | M, 29 | Hemorrhoidectomy, papillectomy | Low spinal | Demerol 100 mg. | CPA cap 1 t.i.d. | CPA cap 1 b.i.d. | 0 | 8/9/51 | 8/15/51 | 27 | Dilatation 7 days PO |
| 83 | M, 49 | Hemorrhoidectomy | Caudal | Demerol 100 mg. t.i.d. | CPA cap 1 t.i.d. | 0 | 0 | 9/17/51 | 9/22/51 | 28 | Dilatation 6 days PO |
| 84 | F, 37 | Fissurectomy, hemorrhoidectomy, papillectomy | Caudal | Demerol 100 mg. | 0 | 0 | 0 | 9/21/51 | 9/29/51 | 26 | Dilatation 5 days PO |
| 85 | M, 59 | Fissurectomy, hemorrhoidectomy, polypectomies | Low spinal | Demerol 100 mg. | 0 | 0 | 0 | 9/18/51 | 9/23/51 | 29 | Dilatation 7 days PO |
| 86 | M, 52 | Hemorrhoidectomy, fistulectomy | Caudal | Demerol 100 mg. b.i.d. | CPA cap 1 b.i.d. | CPA cap 1 | 0 | 10/11/51 | 10/21/51 | 30 | Dilatation 5 days PO |
| 87 | F, 70 | Hemorrhoidectomy | Caudal | Demerol 100 mg. | 0 | 0 | 0 | 8/27/51 | 8/31/51 | 26 | Dilatation 7 days PO; chemotherapy 5 weeks prior to surgery |
| 88 | M, 46 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. | 0 | 0 | 0 | 10/12/51 | 10/17/51 | 28 | Dilatation 6 days PO |
| 89 | M, 53 | Fissurectomy, hemorrhoidectomy | Low spinal | Demerol 100 mg. | 0 | 0 | 0 | 10/15/51 | 10/20/51 | 26 | Dilatation 6 days PO |
| 90 | F, 26 | Fistulectomy, excision of abscess cavity | Low spinal | 0 | 0 | 0 | 0 | 6/24/51 | 7/1/51 | 31 | Dilatation 7 days PO |
| 91 | F, 31 | Fistulectomy, hemorrhoidectomy, papillectomy | Caudal | 0 | 0 | 0 | 0 | 9/10/51 | 9/15/51 | 37 | Dilatation 6 days PO |
| 92 | M, 51 | Hemorrhoidectomy | Caudal | Demerol 100 mg. b.i.d. | CPA cap 1 b.i.d. | CPA cap 1 | 0 | 11/8/51 | 11/17/51 | 31 | Dilatation 5 days PO in hospital |
| 93 | F, 40 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. | 0 | 0 | 0 | 11/20/51 | 12/3/51 | 27 | Dilatation 5 days PO |
| 94 | F, 48 | Hemorrhoidectomy, fissurectomy | Caudal | Demerol 100 mg. b.i.d. | 0 | 0 | 0 | 11/26/51 | 12/1/51 | 27 | |
| 95 | F, 37 | Hemorrhoidectomy, fissurectomy, polypectomy | Low spinal | Demerol 100 mg. | 0 | 0 | 0 | 11/20/51 | 12/4/51 | 35 | Dilatation 6 days PO |
| 96 | M, 31 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. | 0 | 0 | 0 | 12/9/51 | 12/13/51 | 28 | Dilatation 7 days PO |
| 97 | M, 51 | Hemorrhoidectomy, polypectomy | Low spinal | Demerol 100 mg. | 0 | 0 | 0 | 12/14/51 | 12/18/51 | 27 | Dilatation 6 days PO |
| 98 | F, 44 | Hemorrhoidectomy, fissurectomy | Low spinal | Demerol 100 mg. b.i.d. | 0 | 0 | 0 | 12/18/51 | 12/22/51 | 22 | Dilatation 5 days PO |
| 99 | M, 34 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. b.i.d. | Phenobarbital gr. 1½ | 0 | 0 | 12/27/51 | 12/31/51 | 24 | Dilatation 7 days PO |
| 100 | F, 43 | Hemorrhoidectomy | Low spinal | Demerol 100 mg. b.i.d. | 0 | 0 | 0 | 1/9/52 | 1/18/52 | 17 | Dilatation 5 days PO |

4. Postoperatively patients were much more comfortable, more active and required less medication for relief of pain than patients in whom thalamyd had not been employed.

5. Thalamyd has resulted in diminished gas formation, cleaner wounds, less odor following surgery and greater comfort in the operated area.

6. Proctoscopic visualization after thalamyd revealed mucosa that was clear and free from ulceration, unlike the inflamed gut with diarrhea following aureomycin and terramycin.

REFERENCES

1. HEINEKEN, T. S. and SENECA, H. Phthalyl sulfacetamide in ulcerative colitis. *Rev. Gastroenterol.*, 15: 511, 1948.

2. HENDERSON, E. and SENECA, H. Sterilization of the human gut with phthalylsulfacetamide. *Am. J. Digest. Dis.*, 16: 372, 1949.

3. TURELL, R. An evaluation of present day surgical procedures in diseases of the lower bowel. *New York Med.*, 6: 16, 1950.

4. LEHR, D. Experimental evaluation of a new gastrointestinal antiseptic, sodium phthalylcetamide. *Gastroenterology*, 12: 648, 1949.

# CLOSURE OF ABDOMINAL INCISION WITH CONTINUOUS STEEL SUTURES*

JOHN R. ROBINSON, M.D.
*Kankakee, Illinois*

DURING the past twenty years many advances in surgery have been made. One of these which has contributed much to the success of complicated surgical procedures is the use of steel wire sutures in the closure of abdominal wounds. Pioneer work in this line was carried out by Babcock, Kaufman, Jones and others.[1,2,4]

This article does not attempt to advocate a new technic of closure but only the use of an already proven type of material in a manner different from that which is usually used.

Since the days of Halsted many surgeons have held to the theory that continuous buried non-absorbable sutures should not be used because of the danger of infection and resultant sinus formation. This series is presented chiefly to illustrate that continuous non-absorbable sutures can be used with little or no morbidity when compared statistically with series using the interrupted methods.[3]

For several years both simple interrupted and figure-of-eight sutures[4] were used in closure with the realization that both of these methods had certain disadvantages. The chief complaint against these methods resulted from breaking of sutures by muscle action. Often the broken sutures produced sticking pain on motion in the late postoperative period. This complication frequently necessitated the removal of these sutures. Other disadvantages of the figure-of-eight method were a more painful wound in the immediate postoperative period and the inability to use this type of suture without tissue strangulation. X-rays taken after surgery revealed many broken sutures, this in itself unimportant but a source of worry to the patient. The time required for interrupted closure also constituted an important deterrent to acceptance of the method.

An accident seven years prior to the use of continuous steel wire sutures was responsible for its conception. In the process of removal of a subcuticular wire from a patient's abdomen the wire was accidentally broken leaving a strip about 6 inches in length in the subcutaneous fat just above the fascia. During the intervening seven years no complications resulted. Because of this it was decided to try continuous wire sutures for closing the peritoneum and fascial layers rather than using the slower interrupted type.

The method utilized in this technic is the continuous running suture which has been used for many centuries. The chief differential points between this closure and that with catgut are two: (1), 3-0 braided steel wire is the suture material employed; second, one complete suture is started at each corner of the wound and continued mesially until the two meet and are tied together. (Fig. 1.)

There are definite advantages to starting the suture at each end and meeting in the middle. First, strength two sutures are relied on in place of one. Second, elimination of slipping and purse-string effect, often resulting from the use of one continuous unlocked suture. Locking of the wire sutures must be avoided as the shearing action from motion of the abdomen could cause breakage. Kinking also must be carefully avoided for it weakens the suture and results in breakage.

The continuous suture has several advantages over the interrupted, namely, a shorter time for wound closure, a lower wound infection rate, a lower sinus formation rate and a lower suture removal rate. In view of these advantages and because of the factors which are attributable to steel wire itself such as the lack of tissue reaction, definite reduction of the lag period of healing, and greater support due to greater strength of suture material (facts of particular importance in debilitated patients with malignant disease) this new method has been successfully employed for the past four years. (Table 1.) No sticking pains, as observed

* From the Kankakee Clinic, Department of Surgery, Kankakee, Ill.

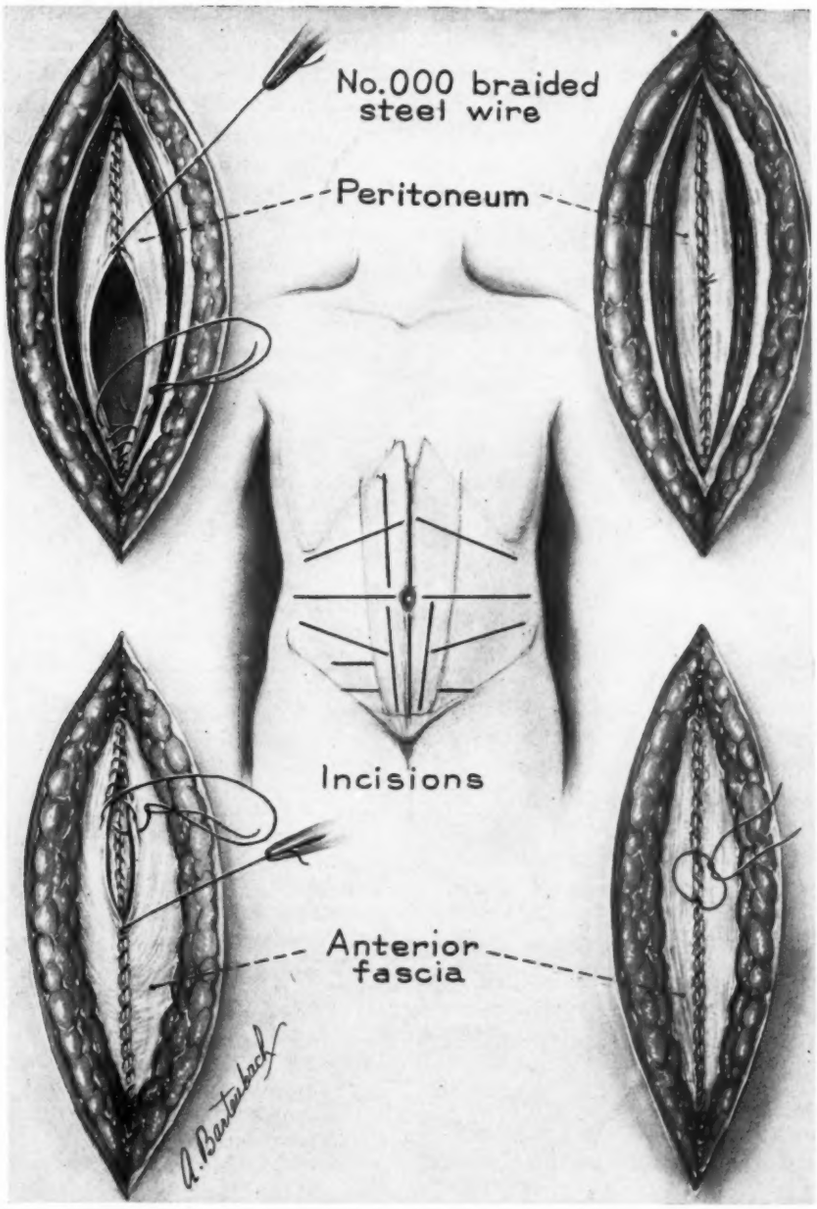



FIG. 1. Upper figures illustrate closure of peritoneum; mid figure illustrates type of incisions closure was used on; lower figures illustrate closure of fascia.

with interrupted wire sutures, have been noted and no sutures have broken.

The closure illustrated in Figure 1 has been used on all types of incisions, both midline, midrectus muscle splitting, vertical and transverse. This method has been carried out in 505 cases in the past four years with excellent results. (Table I.) There have been no wound disruptions in the series. Wound sepsis has occurred in three patients, one of whom had a ruptured appendix. No draining sinuses have resulted. One suture only had to be removed. This suture was not broken but one end, which had been cut too long, was causing sticking pains on motion. So far as can be determined by careful follow-up studies none of the others have caused any discomfort. The follow-up of this series has been complete on all but six cases for a period of at least one year or more.

These series were analyzed by the use of the Chi-square formula for statistical comparison. (Table II.) The type incisions (Fig. 1) used in both series were approximately the same and

insofar as could be determined the case sampling was the same in both series.[5]

The assumptions tested with the use of Chi-square were: (1) the incidence of wound infections in series I and II is the same; (2) the incidence of broken sutures is the same in both series; (3) the incidence of wound disruption is similar in both; (4) frequency of sinus formation is the same in series I and II.

TABLE I

| Type of Case | No. |
|---|---|
| Colon resections | 88 |
| Splenectomy | 4 |
| Gastric surgery | 51 |
| Appendectomy | 30 |
| Inguinal hernias | 86 |
| Incisional hernia | 11 |
| Biliary tract | 126 |
| Pancreas | 3 |
| Pelvic surgery | 101 |
| Lumbar and thoracic sympathectomy | 5 |
| Total | 505 |

Statistical analysis shows that the incidence of wound infections and broken sutures is undoubtedly not the same in both series and that both complications are unquestionably less with the use of continuous wire than with the use of interrupted wire. However, the incidence of wound disruption and sinus tract formation between the two series of observations is not significantly different.

The probability that the frequency of sinus tract formation is different between the two series is great but is not sufficiently great to warrant the acceptance of the apparent difference without a little reservation.

In summary, from a statistical standpoint, there is no question but that the frequency of wound infections and broken sutures is less when wounds are closed with continuous wire than when closed with interrupted; the frequency of sinus tract formation is less with the continuous closure at the 1 per cent level of significance; and there is no significant difference in frequency of wound disruption in the two types of closure.

TABLE II
STATISTICAL ANALYSIS

| Category for Comparison | Series I* (620 Cases) | Series II† (505 Cases) | $X^2$ | Probability |
|---|---|---|---|---|
| Wound infection | 16 | 3 | 57.2375 | .001 |
| Broken sutures removed | 23 | 1‡ | 253.87 | .001 |
| Wound disruption | 1 | 0 | No significant difference | |
| Sinus tract formation | 8 | 0 | 6.6608 | .01 |

* interrupted wire technic (1946–1948)
† continuous wire technic (1949–1952)
‡ not broken but so classified because of removal (see text)

REFERENCES


1. Babcock, W. W. Ligatures and sutures of alloy steel wire. *J. A. M. A.*, 102: 1756–1757, 1934.
2. Kaufman, L. R., Johnson, W. L. and Lesser, A. Clinical study of alloy steel wire sutures and hernia repair. *Surg., Gynec. & Obst.*, 69: 684–687, 1939.
3. Able, A. L. and Hunt, A. H. Stainless steel wire for closing abdominal incisions. *Brit. M. J.*, pp. 379–384, August 21, 1948.
4. Jones, T. E., Newell, E. T. and Brubaker, R. E. The use of alloy steel wire in the closure of abdominal wounds. *Surg., Gynec. & Obst.*, 72: 1056–1059, 1941.
5. Moyer, C. A. Personal communication. April, 1952.

# THE HYPERSENSITIVE CAROTID SINUS REFLEX*

ELMER HOFFMAN, M.D. AND SAMUEL ROCHBERG, M.D.
*Baltimore, Maryland*

THE recognition and treatment of a carotid sinus reflex should be familiar to all surgeons and anesthesiologists. This condition may occur in a patient with or without a previous history of a hypersensitive carotid sinus and if unrecognized may lead to such diagnoses as cardiac arrest or "circulatory failure." The correct diagnosis may mean the difference between life and death in terms of therapy. Although the condition, carotid sinus reflex, is not rare, its incidence is supposedly low.

TABLE I
CAUSES OF HYPERSENSITIVITY OF THE CAROTID SINUS

| | |
|---|---|
| Morphine | Calcium |
| Light anesthesia (ether, vinethene or chloroform) | Strychnine |
| $N_2O - O_2$ | Moderate anoxemia |
| Digitalis | Mild asphyxia |
| Thyroid extract | Emotional states (fear) |
| Excess $CO_2$ (moderate doses) | Arteriosclerosis of carotid arteries |
| Epinephrine | Arteriosclerosis of coronary arteries |
| Ephedrine | Inflammation of neck |
| Nicotine | Tumors of neck |
| Eserine | Operation in the neck |
| Avertin | Intrinsic hypersensitivity |
| | Pressure on neck by anesthetist |

There is a bulbous dilatation of the first part of the internal carotid arteries beginning at the bifurcation of the common carotids. The adventitia of this dilated portion is somewhat thicker than that of the rest of the vessel and contains within its layer special nerve endings and receptors. This bulbous dilatation with its covering is known as the carotid sinus. Usually the location of this portion of the carotid artery corresponds to the region just below the angle of the jaw at the level of the lower border of the thyroid cartilage. However, this position of the sinus may be variable.[1,2]

The afferent innervation of the carotid sinus consists of branches from the glossopharyngeal, the vagus and the cervical sympathetic nerves. Occasionally branches from the hypoglossal nerve are found. The nerve of Hering is the name given to the glossopharyngeal afferent branch.

The carotid sinus reflex is a combined reflex whose efferent motor pathways are considered to be three in number: (1) vagal producing bradycardia, asystole, cardiac arrhythmia, fall in blood pressure, cerebral anoxemia, unconsciousness and convulsions; (2) vasomotor-depressor nerves' pathway producing a vasodilatation of hypotension possibly leading to cerebral anoxemia with convulsions or unconsciousness; (3) the central motor or cerebral pathways producing sudden unconsciousness with no change in pulse or blood pressure. The third type would not be discovered if a patient were under a general anesthetic. Ordinarily the reflex found clinically is a mixed type, demonstrating motor activity along all three pathways.

TABLE II
CAUSES OF HYPOSENSITIVITY OF THE CAROTID SINUS

| | |
|---|---|
| Chloral hydrate | Quinine |
| Deep anesthesia (ether, vinethene or chloroform) | Severe asphyxia |
| | Hypocalcemia |
| | Large doses of strychnine |
| Large doses of barbiturates | Shock |
| | Ether |
| Large doses of caffeine | Procaine (direct application |
| Alcohol | |

The causes of hypersensitivity and hyposensitivity of the carotid sinus are listed in Tables I and II.[1,3–7]

The treatment for a carotid sinus reflex must be immediate and definite if one is to avoid a fatality or a cerebral accident. If therapy is successful, normal pulsations will return within one-half to one minute.

Lahey[8] suggests differentiation from cardiac arrest by placing a needle into the myocardium and watching for the flick of the needle. If there is none, one should institute therapy for cardiac arrest.

The first step in the treatment of carotid sinus reflex occurring during an operative pro-

* From the Department of Surgery, Sinai Hospital, Baltimore, Md.

cedure is to stop the operation completely. This includes not attempting to perform a rapid closure. At the same time one should remove any packs or retractors which might be causing pressure on the carotid sinus region. The anesthetist should check on whether he has caused too much pressure on the carotid bifurcation region through the maneuver of hooking his finger on the angle of the jaw, for just behind the angle of the jaw may be the dangerous point.[5] Discontinue the administration of anesthesia but continue giving oxygen. An endotracheal airway should be established and maintained. The patient should be placed in the Trendelenburg position in an effort to increase the cerebral blood flow and to prevent aspiration. The surgeon should inject from 3 to 10 cc. of a 1 or 2 per cent solution of procaine hydrochloride into the region of the carotid sinus. Eversole[9] suggests the introduction of a hypodermic needle with the bevel down so that it penetrates only under the adventitia. With this technic a single injection will diffuse between the coats of the carotid artery up, down and posteriorly.

Drug therapy is usually unsatisfactory. Atropine sulfate, gr. $\frac{1}{100}$ intravenously, may abolish the vagal component of the reflex but it has no effect on the other aspects. Scopolamine may be used instead of atropine. Epinephrine and ephedrine have been used on the vagal and depressor types. However, one must be careful in using epinephrine, for in a patient with increased vagal tone this may lead to ventricular fibrillation. The use of nor-epinephrine to combat the depressor phase has not been mentioned in the literature. Its values deserve exploration. Since it is known that barbiturates diminish the vagal and depressor types of reaction and that the shorter acting drugs such as evipal and pentothal suppress them completely, use should be made of these compounds both for induction and for convulsions.

By way of prophylaxis one might consider routine preoperative testing for hypersensitive carotid sinus. If one has a patient with a hypersensitive reflex, preliminary infiltration of the carotid artery bifurcation with procaine should be considered, especially if the operative procedure is to take place in the neck. Also, preoperative barbiturate medications should always be used, as well as pentothal for anesthesia. Morphine increases the reflex excitability of the carotid sinus[4] and its use should be avoided. Atropine or scopolamine should be used preoperatively. Because of the rapidity with which therapy must be instituted, the surgeon should have a sterile syringe, needle and 1 per cent procaine hydrochloride at the operating table at all times.

The case which we wish to report is that of a carotid sinus reflex occurring during the course of a secondary thyroidectomy.

## CASE REPORT

B. S. (U-52706), a fifty-nine year old white woman, entered the hospital with the chief complaints of nervousness, palpitation and swelling of her neck of eight months' duration. Approximately ten years before admission the patient had had a subtotal thyroidectomy for diffuse toxic goiter. Postoperatively the picture of a thyroid "storm" had developed but she recovered uneventfully. The patient remained well until the present illness began, except for a hospital admission in 1947 for influenzal meningitis for which she was successfully treated. This woman had been a known diabetic for thirty years before admission. She had been on digitalis for the seven years before admission for hypertension, exertional dyspnea, ankle edema and precordial pain.

The present illness began with nervousness, palpitation and tinnitus aurium approximately eight months before admission. The patient began to notice difficulty in swallowing, palpitations, occasional choking sensation, nervousness, irritability and a mass on the left side of her neck approximately four months before admission. Work-up by the patient's physician revealed that she had recurrent nodular goiter with hyperthyroidism. She was placed on propylthiouracil therapy. Lugol's solution was begun two weeks before the contemplated operative day.

On admission to the hospital the patient was in no acute distress. Her blood pressure was 150/90 (R. A.) and 160/100 (L. A.), with a pulse rate of 80. Complete preoperative study revealed a resting pulse of 60 to 80 beats per minute, a basal metabolic rate of −1, normal esophagoscopy and laryngoscopy, displacement of trachea to right and normal chest findings by roentgenograms. Blood chemistries, renal function tests, venous pressure and circulation time were within normal range.

The patient was taken to the operating room where a nodular mass 7 by 5 by 4 cm. in size was found occupying the left side of and overlying the trachea. The carotid bundle and recurrent laryngeal nerve were firmly adherent to this mass. During the course of the dissection the anesthetist noted that suddenly there was no pulse and no blood pressure. There had been practically no blood loss up to that point. The retractors were noted to be pressing directly upon the carotid bifurcation. These were removed and 1 per cent procaine hydrochloride was infiltrated into the carotid bifurcation region. Within seconds after the infiltration of the carotid sinus with 1 per cent procaine hydrochloride the blood pressure became audible at 80/60. This pressure persisted for several minutes. To prevent prolonged hypotension with resultant cardiac hypoxia, ephedrine sulfate (50 mg.) was injected intravenously; the improvement was prompt and satisfactory. The operation was completed and the patient had an uneventful postoperative course. An attempt to reproduce this reflex postoperatively was unsuccessful.

It was concluded that we were dealing with an elderly woman in whom a hypersensitive carotid sinus reflex had developed during a secondary surgical procedure in the neck. She had the following conditions which might have contributed toward the development of hypersensitivity: (1) hyperthyroidism, (2) digitalis therapy, (3) hypertension, (4) diabetes, (5) nervousness and irritability, (6) mass in neck, (7) previous neck surgery and (8) pressure of retractors on the carotid bifurcation.

SUMMARY

1. A brief description of the carotid sinus reflex, its anatomy, physiology and pharmacology has been presented.

2. The treatment of such a reflex is summarized, with a few suggestions on prophylaxis and an illustrative case report.

REFERENCES

1. Arp, C. R., Dawson, H. M. and Altwater, J. S. Carotid sinus syndrome. *J. M. A. Georgia*, 39: 196–204, 1950.
2. Smith, H. L. A consideration of the hyperactive carotid sinus reflex syndrome. *M. Clin. North America*, 31: 841–844, 1947.
3. Ruzicka, E. R. and Eversole, U. H. The carotid sinus in anesthesiology. *Labey Clin. Bull.*, 3: 47–54, 1942–1944.
4. Rovenstine, E. A. and Cullen, S. C. The anesthetic management of patients with a hyperactive carotid sinus reflex. *Surgery*, 6: 167–176, 1939.
5. Downs, T. M. The carotid sinus as an etiological factor in sudden anesthetic death. *Ann. Surg.*, 99: 974–984, 1934.
6. Weese, H. Concerning the mechanism of anesthesia. Accidents in sublingual phlegmons. *Current Researches in Anesth. & Analg.*, 18: 15–21, 1939.
7. Ferris, E. B., Jr., Capps, R. B. and Weiss, S. Carotid sinus syncope and the bearing on mechanism of unconscious fate and convulsions. *Medicine*, 14: 377–456, 1935.
8. Lahey, F. H. Operative and postoperative complications. *S. Clin. North America*, 30: 785–797, 1950.
9. Eversole, U. H. Role of the anesthesiologist in the management of thyroid patients. *S. Clin. North America*, 30: 673–685, 1950.

# Obstetric Clinic

THE woman about to become a mother or with a new-born infant upon her bosom, should be the object of trembling care and sympathy wherever she bears her tender burden, or stretches her aching limbs. The very outcast of the streets has pity upon her sister in degradation, when the seal of promised maternity is impressed upon her. The remorseless vengeance of the law brought down upon its victims by a machinery as sure as destiny, is arrested in its fall at a word which reveals her transient claim for mercy. The solemn prayer of the liturgy singles out her sorrows from the multiplied trials of life, to plead for her in her hour of peril. God forbid that any member of the profession to which she trusts her life, doubly precious at that eventful period, should hazard it negligently, unadvisedly or selfishly.

OLIVER WENDELL HOLMES

**12th of the Series**

## PELVIC TUMORS*

CHARLES A. CORDON, M.D.

*Professor Emeritus of Obstetrics and Gynecology, State University of New York, College of Medicine (New York City)*

ALEXANDER H. ROSENTHAL, M.D. AND JAMES L. O'LEARY, M.D.

*Associate Professor of Clinical Obstetrics and Gynecology, State University of New York, College of Medicine (New York City)*

*Associate Obstetrician and Gynecologist, St. Catherine's Hospital*

*Brooklyn, New York*

THE association of pelvic tumors and pregnancy may give rise to serious problems which require good judgment for their solution. These tumors are often discussed as complications of pregnancy; but since they generally antedate the pregnancy, the complication is not the tumor but the pregnancy. The distinction except in the case of abortion and ectopic gestation is largely academic, for it is the tumor and not the pregnancy which commonly demands attention. Myomas of the uterus, commonly called fibroids, and less often ovarian tumors are of considerable importance. Cancer of the cervix must be borne in mind. More rarely tumors of the bony pelvis, retroperitoneal neoplasms, vaginal cysts and tumors of the rectum and sigmoid may cause dystocia.

CASE 1. A woman thirty-five years of age and pregnant eight weeks was admitted to the hospital for therapeutic abortion; she had lost her first baby from eclampsia and had nearly died during a convulsion. Her blood pressure was 145/80. The urine was negative but her total output was consistently low. Three or four episodes of bleeding had occurred during the seventh and eighth weeks.

Because of brisk hemorrhage during the operative procedure the uterus and vagina were packed. With the curet a round fibroid of good size was clearly felt in the uterine cavity. Shortly afterward the patient was found to be in shock, with her blood pressure 80/70, but she improved with morphine and transfusion. Pallor was marked and the pulse rapid and small. She complained of pain in the epigastrium which radiated to the right shoulder. It was at first thought that the uterus had been perforated, yet the patient soon felt better and except for pallor and slight abdominal distention she appeared well. The vaginal packing was removed the next

* Cases are from the Committee on Maternal Welfare of the Medical Society of the County of Kings, Brooklyn, N. Y. The text of the case reports is essentially as submitted to the Committee. The views expressed are those of the authors.

day. Vaginal bleeding had been scant. Low grade fever and distention continued for ten days and the diagnosis was parametritis. When her temperature sharply rose to 104°F., a diagnosis of pelvic abscess was made. Posterior colpotomy was performed without anesthesia and 300 cc. of foul dark blood evacuated. Death occurred on the twentieth day after operation.

*Questions.* (1) Was there good reason for therapeutic abortion? (2) What part did the tumor play in this patient's death? (3) Should not the patient's abdomen have been opened shortly after curettage?

*Answers.* It may truly be said that every woman with eclampsia nearly dies, yet it is equally true that but 10 per cent of all women who have eclampsia ever have it again. A history of eclampsia then is not a good reason for interrupting the next pregnancy.

The patient bled repeatedly and, as a matter of fact, abortion may have been inevitable, even incomplete. Given a little more time the problem may have been easier to solve. The operation was not a simple one. It should not be necessary to pack the uterus and vagina if tissue removal has been complete. Perforation of the uterus was followed by shock. In all probability vaginal bleeding had been so profuse that the patient's poor condition was ascribed to that. If proper weight had been given to shoulder pain and persistence of distention or if shifting dullness or fluid wave had been looked for or vaginal examination performed, hysterectomy would have been performed. Myomas which distort the uterine cavity add to the risks of hemorrhage and infection from retained tissue.

* * * *

CASE 11. Over a period of fourteen years a woman had consulted many doctors for infertility. Her uterus was large and asymmetric, and myomectomy had been suggested to her several times. At the age of thirty-nine years she had her first scanty menstrual period, missed her next period and was given large doses of stilbestrol. During the next few weeks she had occasional spotting until she bled profusely and was admitted to the hospital.

Placental tissue was found within a wide open cervix and a diagnosis of incomplete abortion of twelve weeks was made. The uterus was emptied by curet and ovum forceps and the cavity iodinized. Immediate postoperative recovery was good. A round mass 3 cm. in diameter, removed with placental fragments, was reported by the laboratory as myoma.

On the second day the patient's temperature rose to 103°F. and signs of peritonitis appeared. Transfusion was repeated. Death occurred ten days after operation with antemortem temperature rise to 108.4°F. At autopsy considerable placental tissue was found adherent in the cavity of a large myomatous uterus. The site of the tumor removal at curettage could not be identified.

*Questions.* (1) Do myomas cause infertility? (2) Is myomectomy indicated for this reason? (3) How is incomplete abortion managed when the uterus contains myomas? (4) How may the patient's anomalous period be explained? (5) Is stilbestrol good therapy for threatened abortion?

*Answers.* Myomas make pregnancy less likely. Just how they cause infertility is not always clear. They may, of course, actually block the oviducts or so alter the endometrium that the fertilized ovum may not find a favorable spot for nidation. Myomas increase the likelihood of abortion. Pregnancy may occur and often does after a period of years of infertility, as in this case, or quickly in a uterus crowded with tumors, some of them enormous.

Myomectomy may be advisable, yet it should not be undertaken hastily or without careful study of both partners. Even then myomectomy thought to be feasible may prove otherwise, or the very operation itself may actually ruin the patient's chances for conception. Nice judgment is required and some good fortune as well. Even if the patient has already had an abortion, it does not follow that myomectomy will solve her problem.

The uterus that is not empty after abortion is not safe. In this case a submucous tumor was removed with ovum forceps. Even then the uterus was not empty although it seems that it should have been. Possibly the tumor was thought to be the principal mass of placental tissue at the time of its removal, so curettage was discontinued. If a myoma should prevent removal of placental tissue, hysterotomy should be performed; whether vaginal or abdominal will depend upon the size and site of the tumor

and the duration of pregnancy. Hysterectomy may be necessary. As after any abortion, the operator should remove tissue with minimum hemorrhage and trauma, and be certain that the uterus is empty.

Slight bleeding at the time of the first missed period is not uncommon and is probably the result of insecure implantation of the fertilized ovum. Diethylstilbestrol is as good therapy for threatened abortion as anything else. As a matter of fact no therapy has been proved to have real value.

* * * *

CASE III. Two weeks after her first missed period a young woman experienced severe abdominal pain and scant vaginal bleeding. Pallor, rapid pulse, moderate shock and an abdominal mass made the diagnosis of ruptured ectopic pregnancy easy. At laparotomy much free and clotted blood was found in the peritoneal cavity. A ruptured left tube was quickly removed and with it several uterine myomas.

The next day the patient's temperature rose to 104.5°F. and her pulse rate to 130. Distention of the abdomen steadily grew worse, pain was sharp at times and the patient died six days later.

*Questions.* (1) What part did removal of the tumors play in the patient's death? (2) What was the cause of death?

*Answers.* Enlarging the uterus, myomas may lengthen the tube, stretch it and narrow its lumen without actually occluding it. The fertilized ovum may then be unable to reach the uterine cavity.

When the peritoneal cavity contains free and clotted blood, it is a poor time to perform myomectomy; and in this case myomectomy was multiple. Blood increases the likelihood of adhesion of small bowel to a myomectomy site. The patient probably died of intestinal obstruction.

* * * *

CASE IV. A woman forty-five years of age who had lost two babies during the second trimesters of previous pregnancies consulted her physician in the tenth week of her third pregnancy. A hard mass could easily be felt in the right lower quadrant of the abdomen.

At term early labor was poor. A consultant found that non-engagement of the vertex was due to a myoma of good size. He advised further trial of labor with the hope that the tumor would retract. After eight hours of labor, lower segment cesarean section was begun under general anesthesia. The anesthetic was very poorly taken, stopped three times for tracheal suction and nearly a half hour had elapsed before incision could be made. The uterus was studded with fibroids of various sizes.

It was impossible to deliver the fetus through the transverse incision which had been made, so a large tumor close to the incision area had to be shelled out first. The fetus was then delivered and the tumor bed sutured. Hemorrhage was finally controlled. The operator wished to perform hysterectomy, but the anesthetist said that the patient's condition would not allow it. Hemorrhage recurred from time to time during the next six hours. Transfusion and stimulation were of no avail.

*Questions.* (1) Should cesarean section have been performed earlier? (2) Was the anesthetic well selected? (3) Was the operative procedure carefully considered? (4) Do myomas grow during pregnancy?

*Answers.* There was no good reason for delay in this case. Aside from the myoma, the patient's age, her obstetric history and the high value of the baby all pointed to elective abdominal delivery. It is a common observation that tumors low in the body of the uterus often retract with formation of the lower segment in the latter part of pregnancy and early labor. It is often good practice to give them time to do so, but only when labor is good and never in a case like this. When this patient's abdomen was opened, she was found to have a great many tumors. When labor drags in a patient known to have one tumor, it is fair to assume that she has more. At any rate time should not be wasted waiting for the tumor under observation to be taken up into the upper segment.

The anesthetic had much to do with the outcome. It is very probable that difficult induction, perhaps aspiration, was due to the patient's fears and anxieties. Her obstetric experiences, so lightly regarded by her physician, were more than she could bear. Epidural block or fractional spinal anesthesia would have been better.

Hysterectomy might have been planned. At least it should have been discussed with the

patient prior to surgery. Why a transverse incision was made close to a large tumor or, for that matter, why the lower segment type of operation was selected at all are hard questions to answer, unless they were conditioned reflexes. To remove the tumor before delivery of the fetus was ill advised. How could the uterus contract? How could the tumor bed be satisfactorily sutured? Postpartum bleedings may have arisen from the myomectomy wound although it is not known to have communicated with the cavity of the uterus.

Myomas appear to enlarge during pregnancy and to regress afterward. Hypertrophy of the muscle tissue and hyperplasia of the tumor stroma have not been demonstrated. Edema may account for an apparent increase in size, and shift in position may make the tumor more easily palpable. Actual acceleration of growth, we think, does not occur in pregnancy.

* * * *

Case v. A mentally defective woman aged thirty-three years was admitted to the hospital for pain apparently due to a large abdominal tumor. Examination showed a hard mass arising in the pelvis and extending to the umbilicus and apparently merging with another very hard mass which filled the entire upper abdomen. No history could be obtained from the patient who appeared to be seriously undernourished, perhaps cachectic. The diagnosis of pregnancy was confirmed by x-ray. The large upper abdominal mass was variously diagnosed as an enlarged liver, ovarian tumor and pedunculated fibroid.

After three weeks in the hospital the patient's abdomen was opened below the umbilicus. The incision was finally lengthened upward but still no connection could be made out between the two masses. As further exploration was impossible, the uterus was emptied of a five-month fetus, with considerably more than the usual blood loss. The upper mass was then found to be an enormous myoma attached to the posterior wall of the uterus just above the cervix by a pedicle about 2 inches thick. The tumor was so firmly adherent to the entire transverse colon that it could not be separated. Considerable hemorrhage accompanied this part of the exploration, so incomplete removal of the myoma was terminated by suture of tumor tissue. Blood transfusion was begun before the abdomen was closed. Shock grew worse, however, and death took place within an hour.

*Questions.* (1) Do myomas cause toxemia or cachexia? (2) Was the operative procedure a proper one?

*Answers.* Myomas do not cause cachexia. The patient's poor physical condition was due to malnutrition. She was admitted to the hospital for abdominal pain and not because of the great size of the tumor. Pain compels attention. In this case diagnosis presented a problem and laparotomy was performed for relief of pain. The tumor was found to have a large pedicle which was difficult to expose. It is rare for pedunculated tumors to arise close to the posterior cervix. If the tumor wall should be found closely fused with the covering of the large bowel, as in this case, separation by sharp dissection may not be practicable; in that event, it is good practice to leave a thin shell of tumor tissue behind.

* * * *

Case vi. A very obese young woman in the third month of pregnancy was admitted to the hospital with a history of vomiting for two days. Pain, at first generalized throughout the abdomen, finally became localized in the right lower quadrant, with maximum tenderness at McBurney's point. Sharp peritoneal rebound pain was present. The white cell count was 12,500, with 80 per cent polymorphonuclear leukocytes. A diagnosis of acute appendicitis was made and laparotomy was performed.

A pregnant uterus was found deep in the pelvis. A large myoma on its posterior surface was thoroughly examined; it was very edematous but was not removed because the patient had been treated for several years for infertility. A retrocecal appendix 9 cm. long and adherent throughout its entire length but otherwise normal in appearance was removed. Postoperative recovery was good and the patient's condition was excellent until the sixth day when complete abortion occurred after six hours of pain and some bleeding. Her temperature promptly rose to 102.5°F. and her abdomen became distended. During the next five days fever was high and the pulse rate at times rose to 140. Distention was great. Treatment was symptomatic. On the twelfth day after operation the abdominal dressings were removed and the abbominal wound found open; bowel was

visible. A large amount of pus showed Staphylococcus aureus in pure culture. Death occurred on the fourteenth day. The pathologist reported that the appendix showed no sign of inflammation.

*Questions.* (1) To what cause were the acute symptoms due? (2) How should this case have been managed?

*Answers.* Appendicitis can be a dreadful complication of pregnancy and operation should not be delayed once this diagnosis is made. However, this patient did not have appendicitis. If her uterine tumor had been discovered at the time of routine antepartum pelvic examination—and this is only one of the reasons why vaginal examination should not be omitted or perfunctory—the crucial diagnostic error would not have been made. Obesity contributed to death. It clearly adds to the risk of parturition, and the experienced obstetrician never accepts responsibility for the obese patient with equanimity.

The patient's early symptoms were due to the pelvic peritonitis caused by degenerative changes within the tumor, probably due to carneous or red degeneration commonly associated with pregnancy. It is thought to be due to local hemolysis probably brought about by venous obstruction at the periphery of the tumor. The pathogenesis of red degeneration of a myoma is dependent upon the nature of its blood supply and the effect of uterine motility. The intramural myoma has many vessels of arteriole and veniole size that penetrate the pseudocapsule of the tumor at all points. When myometrial contraction occurs, a shift in the relationship of surrounding myometrium and periphery of the tumor takes place, with kinking of blood vessels. The higher pressure in the arterioles permits blood flow into the tumor although venous obstruction hinders the outflow. Thus a state of chronic passive congestion is set up with characteristic dilatation of blood spaces within the tumor. Subsequently rupture of venous vessels occurs with hemorrhage, hemolysis and degeneration of tissue. The typical beefy, swollen, red appearance of red degeneration is thus produced. Increased vascularity and especially motility during pregnancy will explain the increased frequency of this type of degeneration at this time.

The patient's abdomen should not have been opened as symptoms due to red degeneration may be depended upon to subside. Certainly a formidable appendix like this one should not have been removed. There was nothing the matter with it other than its length and location. Nor should the myoma have been so painstakingly examined. Apparently, however, the patient did well until the sixth day, when abortion was followed by bursting open of the abdominal wound. Exploratory laparotomy may well be indicated if reasonable doubt exists as to diagnosis. Prophylactic appendectomy in the presence of intrauterine pregnancy is never indicated.

* * * *

Case VII. A forty-two year old multipara who had had two easy spontaneous deliveries was admitted to the hospital at term with the onset of labor. There was some concern over her blood pressure which was 140/90, since there had been no prenatal care whatever. The next day she went into active labor, and after sharp pains every three minutes for about five hours vaginal bleeding occurred and she was taken to the delivery room for vaginal examination. The cervix was found to be thick and but 3 cm. dilated; a long loop of non-pulsating cord was found in the vagina. Her membranes were not known to have been ruptured. Her abdomen was tender and a globular mass was found to the left of the uterus; fetal heart tones could not be heard. The mass was diagnosed as a fibroid. Pain had largely subsided and uterine contractions were weak and occasional.

The next day, eighteen hours later, the patient's temperature was 98.4°F., the pulse rate 120 and her blood pressure 130/90. She was restless and apprehensive and complained of abdominal pain although there were no uterine contractions. Rectal examination showed the presenting part to be floating. The mass felt abdominally was again diagnosed as a fibroid undergoing degenerative change. Sedation was ordered. Ten hours later the patient's restlessness had increased considerably; her temperature had risen to 101°F., her pulse to 130 and the respiratory rate was 34 to 44. In a few hours profound shock occurred, the pulse became imperceptible and the respirations rapid and labored. On the third day crepitus was noted in the abdominal wall above the pubes and Welch bacillus infection was diagnosed. Death in profound shock soon followed.

At autopsy a term fetus was found free in the

peritoneal cavity but for the head which was still tightly held in the lower segment. Approximately 2 L. of clotted blood were found in the lumbar gutters and a large rent was noted in the posterolateral part of the lower uterine segment. The placenta, completely detached, partly plugged the rent.

*Questions.* (1) Is the term fibroid correct? (2) Since this patient did not have a tumor, why is this case included in a discussion of pelvic tumors? (3) Was the diagnosis of degenerating fibroid well supported?

*Answers.* Myomas of the uterus, as the term implies, are derived from muscle cell elements and not from fibrous tissue. Fibroid is a purely clinical term hallowed by long usage.

This case will show that it is important to know when a patient does *not* have a uterine tumor. Diagnosis is often difficult, but the diagnosis of degenerating fibroid was made solely upon the finding of a hard round lump in the neighborhood of the uterus. On admission the patient had no complaint but early labor. She was in the hospital overnight and no such mass described as hard and tender could have been missed; nor do myomas suddenly degenerate in the midst of labor.

When the cord prolapsed, vaginal examination should have been performed, not rectal. It is amazing to what lengths some of us go to avoid vaginal examination. When a multipara after strong uterine contractions every three minutes for five hours bleeds vaginally and labor suddenly stops, diagnosis of rupture of the uterus should be clear. All these symptoms have already been discussed by us in these Clinics.

* * * *

Case VIII. Myomectomy in the fourth month of pregnancy in a woman thirty years of age was followed by abortion. In her second pregnancy the abdomen was very large. Fibroids were numerous; one in the left lower quadrant of the abdomen was measured as probably 14 cm. in diameter. X-ray at term showed vertex presentation, R.O.P. and a mass assumed to be the large fibroid. No abnormality of the fetus was noted.

For the first eight hours of labor the cervix became fully dilated, the fetal heart tones remained good and the vertex descended to mid-pelvis in R.O.T. position. During the next few hours, however, rotation did not occur. Attempts at manual and Kielland forceps rotation were unsuccessful, so a hand was passed into the uterus to discover what was wrong. A large swelling of the fetal thorax was found to be the cause of failure of progress. Version could not be accomplished until incision was made into the fetal tumor and large quantities of gelatinous material evacuated.

Blood loss was not excessive but delivery was followed by shock. Infusion of glucose and plasma had been continued. Exploration of the uterus showed no rupture. Penicillin and sulfadiazine had been administered prophylactically from the time of rupture of the membranes. Death was said to be due to peritonitis. The fetal tumor proved to be a cystic tumor of the salivary gland which weighed, after it had been emptied, 870 gm.

*Questions.* (1) Should this patient have had cesarean section? (2) Was this case well managed?

*Answers.* This is a diagnostic error of another kind. A large tumor could easily be felt abdominally. The great size of the patient's abdomen was assumed to be due to the presence of a great many myomas. X-ray films were taken but misinterpreted. A large mass thought to be a uterine tumor proved to be a tumor of the fetus. Naturally one shrinks from delivering a monster like this by cesarean section, yet abdominal delivery would not have been accompanied by shock. Cesarean section might well have been elected or performed before rotation of the head was attempted.

* * * *

Case IX. Cesarean section was planned for a young primipara. Multiple myomectomy a few years before had been complicated by abdominal wound rupture, evisceration, intestinal obstruction and pulmonary embolism.

During the eighth month of pregnancy she was suddenly seized by sharp pain in the abdomen. Rupture of a myomectomy scar was promptly diagnosed and operation was performed within the hour. Free blood was found in the peritoneal cavity. A rent in the anterior wall of the uterus, about 1 inch long and covered by a heavy clot, was enlarged and a living fetus weighing 2,125 gm. extracted. After manual removal of the placenta the uterine incision was

closed. Death shortly after operation was due to aspiration of vomitus under gas-oxygen-ether anesthesia.

CASE X. Under caudal anesthesia cesarean section was performed as planned one week before term, the indication being previous cesarean section. The patient was twenty-seven years of age and in excellent condition. A large, soft, bluish protuberance was found on the interior wall of the uterus. This was thought to be a uterine neoplasm, so supravaginal hysterectomy was performed. The right tube and ovary were removed as well because of ovarian endometriosis.

The next day the patient's temperature was 101.5°F. She was vomiting, restless and her abdomen was distended. Morphine did not quiet her. Intravenous glucose and gastric siphonage did not help. On the following day she had a bowel movement but her temperature was higher. A large amount of watery discharge from the wound was noted but the patient's condition did not permit reopening of the abdomen. At any rate, the skin sutures held. Death occurred on the fourth day.

The pathologist found no tumor in the uterus which had been removed. The mass noted in its wall consisted of a fairly well localized collection of blood and clot at the site of the old scar which had separated the uterine muscle and stretched the serosa.

*Questions.* (1) How is rupture of a myomectomy scar diagnosed? (2) Is it a common occurrence? (3) Should hysterectomy be performed after rupture of a myomectomy scar? (4) Should every patient who has had myomectomy have cesarean section in subsequent pregnancy? (5) Did the second patient have wound rupture as well as the first?

*Answers.* It is impossible to know that a scar in the uterus, whether of myomectomy or cesarean section, is about to rupture. It is said that tenderness localized over the scar, especially near term, is significant, but how can one know where the scar is or be certain of tenderness? In mild cases even after rupture diagnosis may be no more than a suspicion. The edges of the scar may part company with minimal bleeding and without rupture of the membranes.

It is not possible to state the frequency of rupture in broad terms of myomectomy. Its frequency should depend upon the size of the tumor, its depth in the wall of the uterus and how the wound healed. The likelihood of rupture is slight indeed unless the uterine cavity was entered or closely approached during the myomectomy. In that event it is but reasonable to expect that the incidence of rupture of the myomectomy scar would be about the same as after classical cesarean section. For future reference, the record should show the length and depth of the myomectomy incision. The woman who has undergone myomectomy will do well to choose the same operator for her delivery.

Whether or not the uterus that has ruptured after myomectomy should be removed will depend upon the character and extent of the laceration. Within reason every effort should be made to save it when the patient still has no baby.

Any considerable amount of serosanguineous or straw-colored fluid on the abdominal dressings is pathognomonic of wound dehiscence whether the sutures appear to be holding or not. Digital exploration of the wound is practically painless and easily accomplished at the time the dressing is changed. In this case there was great delay in its recognition.

* * * *

CASE XI. A woman twenty-six years of age who had had one spontaneous abortion visited her doctor early in the fourth month of her second pregnancy. A round cystic tumor about the size of an orange was easily felt both abdominally and vaginally. Largely because of fear that abortion might result, operation was considered but not performed.

At term labor was at first poor. The vertex was in L.O.P. position. After forty-six hours the vertex was found at the spines and the cervix was almost fully dilated. The membranes had been ruptured for four hours. The fetal heart tones were not good and meconium had been noted.

Under cyclopropane anesthesia the perineum was ironed out and manual rotation of the head was attempted. Suddenly the cord prolapsed. Version was then accomplished without difficulty. After a half hour of gentle traction the shoulders appeared at the vulva and the fetal head gave no trouble. The baby survived. Hemorrhage during the third stage of labor and afterward was considerable. The patient's systolic blood pressure fell to 60 and her pulse became thready. The uterus was then tightly

packed; but since the patient's blood pressure continued to fall, the packing was removed and the uterus explored. A rupture was found anteriorly in the lower uterine segment.

The patient was then taken to the operating room and laparotomy performed. Blood transfusion continued. A transverse tear about 3 inches long was found to extend from one broad ligament to the other. A necrotic ovarian tumor, not very cystic and considerably larger than the fetal head, was found incarcerated in the cul-de-sac. The adherent uterus had to be removed with the tumor. The patient's temperature was 104° or 105°F. all the next day and her pulse rate remained above 160. She died on the second day with her temperature 107.2°F. The tumor was reported as a necrotic, partly cystic teratoma.

*Questions.* (1) Should the ovarian tumor have been removed when the patient first visited her doctor? (2) Will postoperative stilbestrol therapy prevent abortion? (3) Was version indicated? (4) When did rupture of the uterus take place? (5) Is a teratoma a cystic tumor? (6) How did this tumor become necrotic?

*Answers.* Operation in the fourth month was indicated. This is perhaps the optimum time. Later in pregnancy the size of the uterus may make removal of the tumor more difficult, thus adding to the risk of abortion. So far as practicable, abdominal incision should be in the midline, for the tumor will not always arise from the side where the operator expects to find it.

Abortion may occur, of course, yet it probably will not if the operator is able to carry on with average gentleness and ease. Even though it should be said that the chances of the fetus for life are not much improved, the mother's chances always are. Earlier in pregnancy the likelihood of abortion appears to be greater although many cases have been reported in which both ovaries had been removed early in pregnancy without subsequent abortion. The placenta plays an important part in the production of progesterone when the corpus luteum begins to regress.

Diethylstilbestrol, the synthetic estrogen, is said to bring about increased utilization of chorionic gonadotropin, thus causing increased output of progesterone. This is debatable. Objections to its use that over 60 per cent of abortions are due to abnormal ova and that abortion is due to many causes which could not conceivably be influenced by this therapy do not apply in this case.

Any ovarian tumor large enough to be felt easily on examination of the abdomen is large enough to warrant its removal. This heavy tumor was not in the pelvis in early pregnancy bur dropped into the cul-de-sac later as its pedicle lengthened with advancing pregnancy. Small round cysts less than 6 cm. in diameter are not apt to be true neoplasms and should not be removed since they may of themselves disappear by resorption of their fluid content.

The ovarian tumor was responsible for long labor and failure of engagement. Since it was known to be present, it is difficult to see why the patient's abdomen was not opened early in labor. Of itself non-descent is ominous. Decision to perform version in the interest of the fetus was suddenly reached after prolapse of the cord, but manual rotation never should have been attempted. A mass as large as the fetal head itself was in the birth canal with it. So often when version is found singularly easy it is because the fetal head at the half-way point further stretches and ruptures the already thinned out lower segment. Transverse rupture as reported in this case is very unusual; that, too, can be attributed to the tumor. Necrosis was due to pressure which must have been so applied as to shut off the arterial blood supply of the tumor.

A teratoma may be cystic or solid. It is a more serious tumor than the cystic benign dermoid. The tissue always shows a mixture of all three fetal layers.

* * * *

Case xii. A primipara whose first baby had been delivered by low forceps visited her obstetrician every three weeks throughout the entire period of her second pregnancy. No pelvic examination was made since the pelvis had been thoroughly studied by x-ray during pregnancy two years previously.

After six hours of good labor vaginal examination was performed and a soft fluctuant mass as large as a grapefruit was felt in the pelvis. The membranes were found to be ruptured and the fetal head well above the pelvic brim. All efforts to displace the mass were unsuccessful, so cesarean section was performed. At that time a teratoma of the ovary was removed.

The tumor weighed 410 gm. and measured 14 by 11 by 6 cm.

For the first few days convalescence was stormy with fever, vomiting and abdominal distention. On the twelfth day, while getting out of bed for the first time, the patient suddenly died of pulmonary embolism.

*Questions.* (1) Should the patient have been examined vaginally early in pregnancy? (2) Is it advisable to attempt to replace a pelvic mass?

*Answers.* That an antepartum vaginal examination should have been performed goes without saying; if not at the patient's first visit, certainly at her second. In the case of pelvic tumors forewarned is forearmed. A tumor of this size could not have been missed and its implications would have been obvious.

Under no circumstances should an effort, no matter how gentle, be made to dislodge a pelvic tumor. It may be ruptured this way and very easily, too, under some circumstances. Even apparent success may mean rupture. Those who are not afraid to make a gentle attempt to move the tumor out of the way stipulate that in every case the patient's abdomen should be opened shortly after delivery.

In the latter months of pregnancy diagnosis grows more and more difficult, even if the cyst is very large. The cyst may not be felt at all, or the findings may continue to be doubtful or become certain so near term that it would be best to await labor and treat the patient expectantly so long as the tumor is not in the pelvis. If the tumor should be found in the abdomen immediately after the placental stage —and this is the best time to look for it— operation should be performed for its removal as soon as the patient's condition will permit.

* * * *

CASE XIII. After fourteen hours of good labor without satisfactory progress a primigravida was examined by a consultant who found an ovarian tumor blocking the pelvis. At laparotomy a dermoid cyst of the right ovary on a long pedicle was easily removed. Before the abdomen was closed, another operator delivered the fetus from below. The head was found deep in the pelvis, and forceps application and delivery were easy.

The patient's condition on the operating table was excellent but shortly afterward she was found in shock. The uterus was firm and there was no undue vaginal bleeding. She was returned to the operating room but died before her abdomen could be reopened. Upon removal of two sutures after death a large amount of blood was found in the peritoneal cavity. It was assumed that the pedicle ligature had slipped.

*Questions.* (1) Why was not the patient delivered by cesarean section instead of by this roundabout method? (2) How is secondary hemorrhage treated?

*Answers.* In this case, also, the ovarian tumor prevented engagement. After removal of the tumor pelvic delivery was quickly and easily accomplished. This was an ideal procedure, sparing the patient from both early and late disadvantages of cesarean section. That is putting it mildly when a dermoid cyst that has been pounded for fourteen hours is inviting peritonitis. If the ovarian artery should be missed by the tie or retract, or the ligature should slip as in this case, the situation at the very best is serious. There is no substitute for making certain. The patient may die quickly, as this one did. The operator may have to make his way to the pedicle through a sea of blood or he may find an immense retroperitoneal hematoma such as was found at autopsy in the case to follow.

* * * *

CASE XIV. A thirty-three year old primigravida with preeclampsia improved with rest and sedatives. In the thirty-sixth week of pregnancy, however, her blood pressure rose again to 150/100 and proteinuria recurred with nausea, vomiting and pain in the left flank. There were but few pus cells in the urine, yet pyelonephritis seemed a likely diagnosis and chemotherapy was instituted. During the next two days pain and tenderness became more marked, the temperature rose to 102°F., a diagnosis of an acute condition of the abdomen was made and laparotomy was performed. A dermoid cyst of good size and twisted on its pedicle was found and readily removed. The next day a stillborn fetus was delivered after a labor of six hours. Blood loss was minimal, yet shock and death followed a few hours later. At autopsy a massive retroperitoneal hematoma was found to originate from the left broad ligament.

*Questions.* (1) Do pregnancy accidents occur more often with dermoids than with other ovarian tumors? (2) What causes twist of the pedicle?

*Answers.* Dystocia is caused more often by dermoid cysts than by other ovarian tumors. Their weight is the principal factor involved in their descent into the pelvic cavity; once there, of course, their pedicles cannot twist but dystocia is inevitable. Twist occurs in the abdomen proper and a certain amount of room is necessary. For this reason pedicles of large tumors cannot twist. Trauma such as a fall or running quickly down a flight of stairs, change in utero-ovarian relationship, Braxton-Hicks contractions and perhaps even peristalsis may initiate twist. Edema and tightening of the tumor capsule follow thrombosis of the pedicle.

* * * *

CASE XV. A forty-four year old woman was admitted to the hospital with nausea, vomiting and abdominal pain which had slowly grown worse for three days. For six years she had had symptoms suggesting gallbladder disease. Amenorrhea had been present for four months. Marked tenderness and some rigidity were present just below the umbilicus to the right. Two masses could be felt abdominally and vaginally; one was clearly the uterus which rose almost to the umbilicus and the other a very sensitive mass as large as an orange. The diagnosis was multiple fibroids, one pedunculated and twisted; pregnancy was not suspected.

At operation the findings were intrauterine pregnancy in a myomatous uterus, a twisted necrotic dermoid cyst and cholelithiasis. The ovarian tumor was excised. The appendix and gallbladder were then removed. Three days later abortion of a four-month fetus occurred and the patient's temperature rose to 104°F. Death on the tenth day was due to pelvic and pulmonary infection.

*Questions.* (1) How was the diagnosis of pregnancy made during laparotomy? (2) Was the operative procedure well considered?

*Answers.* The color and consistency of the pregnant uterus are fairly typical. The relationships of the uterine fundus, round ligaments and tubes and ovaries are significant. Round ligaments and tubes are congested and thick. A large corpus luteum may be seen. If the operator should still be in doubt, the uterus may be incised exactly vertically, slowly and carefully; if amnion is encountered, the incision may be closed. The risk of abortion is not great.

Necrosis of an ovarian dermoid is inevitably associated with very high mortality. Appendectomy should not be performed no matter how simple it may appear to be, and thought of cholecystectomy should not even occur to the operator.

* * * *

CASE XVI. A multipara twenty-one years of age complained of pain in the right thigh. A few months before, the right pubic bone had been fractured in an automobile accident, so her pain was attributed to that. Pain had been gradually growing worse but heavy callus in the soft tissues was thought to be the reason.

When the patient was admitted to the hospital for further study, a diagnosis of pregnancy of about eight weeks was made. Vaginal examination was difficult because of a hard insensitive mass; above and below the descending ramus. Biopsy showed osteogenic sarcoma. Death occurred in the fifth month of pregnancy.

*Questions.* Are fractures of the pelvis common causes of dystocia? (2) What is the lesson in this case?

*Answers.* Automobile accidents are so common that fractures of pelvic bones might be expected to cause considerable dystocia. However, such is not the case. End results, of course, will depend upon the location of the fracture and how well it healed. Callus or deformity will be shown by x-ray. Tumors which arise from the walls of the pelvis will make delivery from below impossible. Malignant disease should never be thought of as foreign to youth.

* * * *

CASE XVII. A primigravida twenty-five years of age had had pain in the left lower quadrant of the abdomen for five days when admitted to the hospital in the fourth month of pregnancy. A large tender mass filled the entire abdomen nearly to the costal margin. There was some rigidity. A diagnosis of ovarian cyst was made.

At laparotomy both ovaries were normal. A large retroperitoneal cyst crowded the pregnant

uterus forward. After 2 L. of bloody fluid had been siphoned off, the tumor was removed, but incompletely. Abortion took place the next day and the patient died on the twentieth day. The diagnosis was hypernephroma.

*Question.* How may a cyst be diagnosed as retroperitoneal?

*Answer.* Diagnosis of a cyst of this great size as retroperitoneal would be, to say the least, difficult. If tympany can be demonstrated over a cyst, the tumor is likely to lie behind the peritoneum. If time permits thorough pelvic examination with urologic investigations including urography should be carried out. A pelvic mass may be a solitary ectopic kidney, or ectopic kidney may be bilateral. Unidentified pelvic masses invite trouble.

* * * *

CASE XVIII. A thirty-seven year old woman who had two children reported to the antepartum clinic in the third month of pregnancy. She had noticed slight vaginal spotting from time to time over a period of two months. She appeared to be in excellent health and physical examination was negative until vaginal examination was performed; the cervix was somewhat hyperplastic and a hard mass about the size of a plum was felt on its anterior lip. Slight spotting occurred at the time of examination. Speculum inspection at subsequent clinic visits showed no change whatever in the appearance of the cervix. The patient reported slight spotting at times, but never after coitus. The clinic diagnosis was cervical fibroid although carcinoma of the cervix was considered.

In the thirty-sixth week delivery was spontaneous and uncomplicated after two hours of good labor. The cervical mass gave no trouble; on inspection, however, it looked different, somewhat polypoid, and a bleeding point was ligated. Convalescence was smooth. Four weeks after delivery, under intravenous anesthesia, the cervical mass was excised and two Sturmdorf sutures well placed. The pathologist reported anaplastic carcinoma of the cervix and heavy irradiation was administered. One year after delivery the patient was symptom-free.

*Questions.* (1) Should the diagnosis of carcinoma of the cervix have been made at the time of the patient's first clinic visit? (2) Did the growth look like a cervical polyp? (3) Suppose that carcinoma *in situ* had been reported at that time, how should it have been treated? (4) What should treatment have been in the third month? (5) Was delivery conducted properly?

*Answers.* Carcinoma of the cervix is the most common type of gynecologic cancer, yet it is infrequently met with during pregnancy so there is nowhere near any unanimity of opinion as to its treatment. The experience of any one individual will be scant but this in no way absolves him of responsibility for diagnosis. Cancer of the cervix is rarely seen in maternal mortality columns not because it does not occur during the reproductive period of life but because death is usually just far enough removed from parturition to escape the coding rules of the statistician.

When bleeding of the spotting type occurs, speculum examination is indicated. Biopsy of the cervix will not cause abortion. The importance of diagnosis cannot be overstated, and diagnosis must be accurate and reliable. Even if the lesion looks like a cervical polyp, it should not be destroyed with the cautery but removed for examination; its base may be cauterized if necessary. The cautery will not cause abortion. Cervical polyps are nearly always small, bright red, fairly well pedunculated and usually arise from the endocervix; bleeding is slight but bright and not different from the bleeding of early carcinoma of the cervix. Actually the growth was thought to be a cervical fibroid, but a myoma does not bleed on touch and a myoma in the anterior lip of the cervix would be unique.

If bleeding should occur during the last trimester, placenta previa must be ruled out. Speculum examination is nonetheless necessary. The importance of biopsy, if it should appear to be indicated, cannot be overemphasized. Vaginal smears are inconclusive. That the cervix undergoes profound change during pregnancy must be borne in mind. Vascularity is great. The stroma becomes thin and edematous, the squamous lining thickens and the glands increase in number and size; hypertrophy and hyperplasia are great. These changes must not be interpreted as malignant. Great caution must be exercised if a diagnosis of intraepithelial carcinoma is made. No therapy for carcinoma should be carried out.

After delivery repeated biopsies are indicated. No woman should be subjected to pelvic irradiation or radical surgery, and no fetus should be destroyed upon a diagnosis of carcinoma *in situ*.

If the lesion is invasive, however, treatment is imperative. On this point there is no disagreement. Early in pregnancy the fetus is disregarded. High dosage x-ray and radium will be followed by abortion. Radical pelvic surgery may have a place. If the fetus is viable, it should be delivered abdominally before other treatment is carried out.

Cesarean section should lessen hemorrhage and infection and the likelihood of quick spread of the growth presumably favored by pelvic delivery. It is of considerable interest, however, that after high dosage x-ray and cervical application of radium during the last trimester patients have been delivered vaginally, usually four to six weeks later. Results appear to be good.

MARTIN et al. compared the results obtained in the treatment of duodenal ulcer when vagotomy was used in over fifty consecutive cases while, more or less contemporaneously, gastric resection was being performed on about 250 different but comparable patients. The end results showed that gastric resection helped approximately nine of ten patients whereas in only 65 per cent did vagotomy produce the desired result. Even in gastrojejunal ulcer these authors found that gastrectomy gave superior results. (*Richard A. Leonardo, M.D.*)

# Practical Surgical Suggestions

## AUREOMYCIN PACKING AS AN ADJUNCT TO THE SURGICAL TREATMENT OF LOCALIZED INFECTIONS*

PETER J. MARCHISELLO, M.D., AARON PRIGOT, M.D.
AND LOUIS T. WRIGHT, M.D.
*New York, New York*

DÉBRIDEMENT and adequate drainage is a basic requirement in the treatment of localized infections. Drainage has been maintained by means of rubber dams, tubing, sterile gauze and gauze impregnated with various types of antiseptic substances. When tubing was used, irrigation of the cavity was possible with antiseptic solutions.

FIG. 1. Convenient sterile packing of aureomycin-impregnated gauze.

Although these substances were effective against the organisms involved in the infections, they were frequently destructive to granulating tissue and sometimes normal tissue[1] because of their non-specific chemical action.

Prior to the advent of chemotherapy and the antibiotics, the use of antiseptic substances such as Dakin's solution, tincture of merthiolate, iodoform, acriflavin, carbolic acid and countless other agents was, for all practical purposes, the only adjunct to the proper surgical management of localized infections. With the advent of the sulfa drugs and subsequently the antibiotics, local antibacterial substances have been prepared in powders, ointments and solutions, but these preparations for a variety of reasons fell short of expectations.

The purpose of this investigation was to evaluate the effectiveness of an aureomycin-impregnated packing† (Figs. 1 and 2) as an adjunct to the surgical therapy of localized infections. This antibiotic has a wide range of activity, is readily soluble and has a low order of toxicity. This study was concerned primarily with the effects on wound healing, antibacterial effects, local and systemic toxicity and allergy.

*In vitro* experiments were devised for the aureomycin packing in order to determine the rate of absorption, solubility and diffusibility of aureomycin, and the effect of aureomycin on specific organisms and on wound healing. Untreated sterile packing and iodoform packing were employed as controls.

A paracolon strain was selected and streaked on an endo plate. Immediately after streaking a

† The aureomycin packing used was kindly furnished by Davis and Geck, Inc., a unit of the American Cyanamid Company, Brooklyn, N. Y.

* From the Surgical Service of Harlem Hospital, Department of Hospitals, New York, N. Y. Aided by a research grant from the Lederle Laboratories Division, American Cyanamid Company, Pearl River, N. Y.

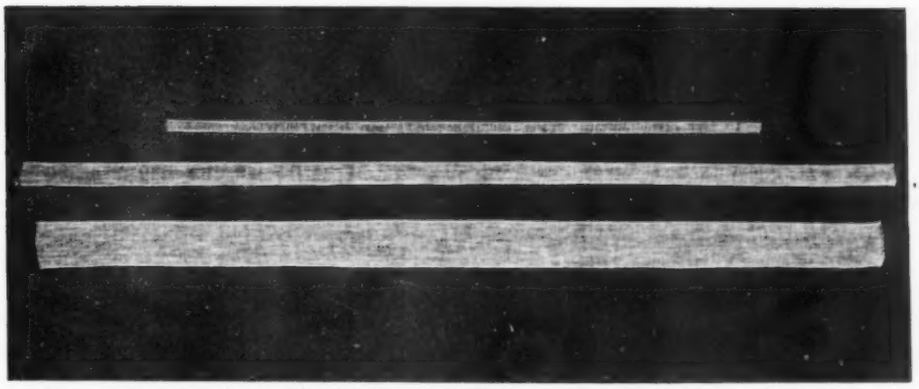


FIG. 2. Aureomycin packing in three widths (top to bottom), ½, 1 and 2 inches.

1 inch pledget of each packing was folded, placed on the media and moistened with distilled water and incubated. After eighteen hours it was evident that the control plain packing did not influence the bacterial growth. On the other hand, a very clear zone of no growth was visible about the aureomycin packing and no significant change could be demonstrated about the iodoform packing. (Fig. 3.) These findings demonstrate the rapid diffusibility, solubility and onset of action of the aureomycin packing over the iodoform packing.

Wound healing varies with many systemic and local factors and the experience of one observer may not be broad enough to warrant a correct conclusion. With the use of tissue cultures[2] whereby controlled conditions were maintained the variables, namely, iodoform, aureomycin and plain packing, were implanted in tissue cultures to determine the effect on growth. Iodoform showed decreased growth. (Fig. 4.) Aureomycin and plain packing showed no impairment of growth of cells in tissue culture. (Fig. 5.) The effect of aureomycin on tissue culture has been previously reported by Antikajian et al.[3] These workers showed that the growth of cells in tissue culture was not inhibited until a concentration of 0.05 mg./ml. of aureomycin was used.

In spite of systemic antibiotic therapy many forms of localized infections have been seen to persist for long periods of time unless treated properly with incision and drainage. The basic pathologic condition is characterized by an inflammatory wall with thrombosed vessels and a total decrease in blood flow resulting in the inability of the antibiotic to reach the infected area. Systemic therapy merely prevents further invasion. Aureomycin packing provides an adequate concentration of the

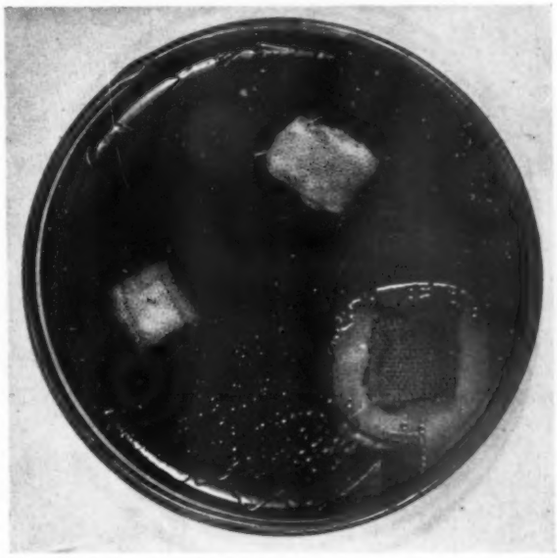


FIG. 3. Endo plate showing zone of no growth around aureomycin packing. Twelve o'clock, plain gauze packing; four o'clock, aureomycin packing; eight o'clock, iodoform gauze packing.

antibiotic within this cavity. One square inch of aureomycin packing makes available 200 μg. of the antibiotic. After sixteen hours in the cavity 65.4 per cent of the drug had been utilized while at the end of forty-eight hours 93.3 per cent of the aureomycin had disappeared. This aureomycin packing makes available within the cavity adequate bactericidal and bacteriostatic levels of the antibiotic over a prolonged period of time.

Most of the infections treated were monomicrobic, the etiologic agents being noted in Table 1. Follow-up cultures revealed a change in the bacterial flora and quite frequently the appearance of contaminants such as proteus and pseudomonas. Although the cultures remained positive, there was a decrease in the total number of organisms. In many cases the

FIG. 4. Inhibition of cell growth in tissue culture by iodoform gauze packing.

FIG. 5. Normal cell growth in tissue culture with aureomycin packing.

healthy appearance of the wound was not commensurate with positive wound cultures.

Twenty-five patients presenting certain forms of localized infections and potentially infected wounds listed in Table II were treated with aureomycin packing. Systemic antibiotic therapy was withheld wherever feasible without undue risk to the patient, primarily to attain ideal conditions for proper evaluation. The proper local management varied with the surgical principle applied and a general anesthetic was administered whenever warranted.

TABLE I

ORGANISMS ISOLATED FROM LOCALIZED WOUND INFECTIONS

| | |
|---|---|
| Staphylococcus albus | 1 |
| Bacillus coli | 3 |
| Paracolon | 2 |
| Gamma streptococcus | 2 |
| Bacillus hemolytic streptococcus | 1 |
| Anaerobic streptococcus | 1 |
| Staphylococcus aureus | 5 |
| Alpha streptococcus | 1 |
| Bacillus proteus | 1 |
| Pseudomonas | 3 |
| Aerobacter aerogenes | 1 |
| Bacteroides | 1 |

All abscesses were immediately incised and drained that were considered to be of pyogenic origin. Local débridement and complete evacuation was done and followed with aureomycin packing. All infected and potentially infected wounds were treated surgically in like manner and packed with aureomycin packing. Postoperatively the removal was managed gradually so that the entire packing was removed by the third day. The longest period of time the packing was left in was five days. After removal of the initial packing the wound was repacked to provide antibiosis and to permit drainage if necessary. The wound was repacked each time as long as the defect persisted. Minimal discomfort was experienced during the applica-

TABLE II

CASES OF LOCALIZED INFECTIONS TREATED WITH AUREOMYCIN PACKING

| | |
|---|---|
| Abscesses | |
| Ischiorectal without fistula | 1 |
| Perianal without fistula | 1 |
| Perianal with fistula | 4 |
| Breast, postpartum | 2 |
| Breast, not postpartum | 5 |
| Hand | 1 |
| Abdominal wall | 1 |
| Dorsum of foot | 2 |
| Bartholin's gland | 1 |
| Perinephric | 1 |
| Wound infections, postoperative | |
| Postabortal sepsis with generalized peritonitis | 1 |
| Excision of pilonidal abscess | 1 |
| Exploratory laparotomy for stab wound of the abdomen, hematoma of wound | 1 |
| Wound infections, not postoperative | |
| Infected sebaceous cyst with abscess | 1 |
| Infected pilonidal sinus with abscess | 2 |
| Total | 25 |

FIG. 6. Shows a patient with a large left cervicofacial abscess.

FIG. 7. Same patient six days after incision and packing with aureomycin gauze.

tion of the packing. Three patients complained of a slight burning sensation which lasted three to four minutes with each packing.

No local or systemic toxicity was noted in any of the patients treated. The foul odor which is characteristic of these infections was considerably reduced. No local or systemic reactions were noted. On the other hand, DaCosta[4] makes specific mention of iodine intoxication following the use of iodoform packing.

## CASE REPORT

A thirty-three year old Negro male was admitted with a history of a human bite of the face one week prior to admission after which progressive swelling and tenderness developed. Physical examination revealed a fluctuant, tender swelling of the left side of the face. The abscess was incised and drained of 60 cc. of purulent material. The wound was packed with aureomycin gauze packing on several occasions. The rapid rate of healing is demonstrated in Figures 6, 7 and 8.

With the use of aureomycin packing there was the early appearance of granulation tissue which permitted secondary closure to be done.

## CONCLUSION

Aureomycin packing is far superior to iodoform gauze, plain gauze or any other type of gauze packing known to us. It is the best packing to be used in any surgical infections in which the use of packing is indicated.

## SUMMARY

Aureomycin packing was found to be a valuable adjunct to the surgical therapy of certain localized infections. It has been shown to make available high concentrations of aureomycin over a long period of time and not to interfere with wound healing. No significant local or systemic toxic effects were noted nor was allergy or local skin irritation in evidence. Odor from infected wounds has been considerably reduced.

FIG. 8. Wound completely healed sixteen days after initiation of treatment.

## REFERENCES

1. ANDERSON, D. P., JR. The problem of wound healing—the effects of local antiseptic agents on infected wounds. *Ann. Surg.*, 108: 918–933, 1938.
2. SALLE, A. J. and LAZARUS, A. S. Comparison of the resistance of bacteria and embryonic tissue to germicidal substances. v. Iodine. *Proc. Soc. Exper. Biol. & Med.*, 32: 1481–1483, 1935.
3. ANTIKAJIAN, G., WRIGHT, L. T., PLUMMER, J. I. and WEINTRAUB, S. The effect of triethylene melamine, aureomycin, and some 4-amino derivatives of folic acid on tissues in vitro. *J. Nat. Cancer Inst.*, 12: 269–274, 1951.
4. DACOSTA, J. C. Modern Surgery, General and Operative, 10th ed., p. 57. Philadelphia & London, 1931. W. B. Saunders Co.

# REPLACEMENT OF THE STOMACH BY THE RIGHT COLON IN TOTAL GASTRECTOMY*

J. J. McAleese, M.D., F. P. Perrone, M.D. and G. B. McAleese, M.D.
*Pittsburgh, Pennsylvania*

TOTAL gastrectomy has attained wide support recently as a sound procedure in gastric cancer surgery. With the lowered morbidity and mortality due to improved surgical practices, this procedure frequently offers the patient a greater chance for cure. In view of the high incidence of this type of carcinoma any improvement in results may provide a considerable increase in the total number of survivals.

Despite this, the prospect of curative surgery for gastric neoplasm remains gloomy. The procedure of total gastrectomy is not without several serious drawbacks. An increase in the number of surviving gastrectomized patients will create a number of problem patients having nutritional and mechanical defects secondary to the absent stomach. Permanent disability sometimes results from partial removal of the stomach and total excision may magnify the difficulties in the life of a survivor. As yet, the total number of survivors in any series is not large enough to evaluate carefully the question of postoperative results in regard to the patient's comfort. The true importance of the symptoms stemming from the absent stomach remains to be determined with respect to the over-all value of total gastrectomy procedure. Physicians who have been associated with gastrectomized patients can recall the large number referred to as "gastric cripples." The sequelae may assume greater proportions the longer the patient lives. To subject an individual to this radical surgery with the knowledge of the high incidence of discouraging results is a difficult judgment to make. Indeed, one may have wondered on occasion if life without a stomach was really preferred by some patients.

The absence of the gastric reservoir constitutes the most important postoperative disability. It is often tragic. This disability remains as one of the few points favoring less radical surgery in the treatment of gastric carcinoma. Commonly, adjustments to an absent reservoir are made by a dilated jejunal pouch only after months or even years of persistent, unpleasant symptoms. A short term survivor having these postoperative complaints emphasizes a prominent disadvantage of total gastrectomy. To have this patient spend his only remaining days with esophagitis, a dumping syndrome, diarrhea or any of the other common sequelae is not welcome. Any improvement would be an advantage.

The recent articles describing the use of the transverse colon[5] or the right colon and terminal ileum[3] to replace the stomach after total gastrectomy seem to present plausible answers to the serious problem of an absent reservoir. Evidence has been presented that the stomach, while in itself not indispensable, does serve a very important reservoir-like function that cannot be assumed easily by a dilated jejunal pouch. It is also conceivable that some benefit might result from the retention of a more normal alimentary pathway with these procedures. The dumping syndrome that may be related to rapid overdistention of upper jejunum might be thereby avoided. Since these procedures are new ones and experience in their use is limited, the following two cases are presented. The method described by Dr. C. Marshall Lee, Jr.,[3] using the terminal ileum and right colon to replace the stomach, was used with these two patients.

## CASE REPORTS

CASE 1. The first patient on whom this procedure was used, Mr. J. V., a forty-five year old white male, was admitted to the hospital October 20, 1951. Five months prior to this he

* From the Surgical Service, Veterans Administration Hospital, Aspinwall, Pa., and the University of Pittsburgh School of Medicine, Pittsburgh, Pa. Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are the result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

had consulted his family physician because of fatigue and weight loss. Examination disclosed a "tumor" in his stomach and surgery was strongly advised. The patient elected to defer treatment at this time for financial reasons. Subsequently, he continued to have weight loss amounting to 30 pounds on admission. Three weeks prior to this he vomited once, the vomitus containing a small amount of bright red blood. He had noticed no melena. On admission he was also having some vague epigastric pain with slight dysphagia. There was no history of previous abdominal difficulty other than an appendectomy in 1949 for what seemed to have been definitely acute appendicitis.

Physical examination revealed negative findings except for obvious evidence of weight loss. Anemia was not present, his red blood count being near 5 million with 15 gm. of hemoglobin. There was absence of free hydrochloric acid on gastric analysis. At gastroscopy it was possible to visualize a neoplasm at the cardiac end of the stomach extending along the greater curvature. X-ray examination showed a constant filling defect in the cardia with definite distortion of the mucosal pattern. The preoperative diagnosis was carcinoma of the gastric cardia.

Cleansing enemas and aureomycin, 500 mg. four times a day for two days prior to surgery, were given in preparation of the patient. On November 7, 1951, under ether anesthesia administered by endotracheal intubation, the lesion was approached through the left thorax. The distal end of the esophagus was mobilized and the diaphragm incised radially. Exploration showed a large carcinoma involving the gastric cardia and extending distally to just beyond the mid-portion of the stomach. It did not grossly invade the esophagus or diaphragm. Neither lymph nodes nor liver were apparently involved.

More adequate exposure was obtained with extension of the incision transversely across the chondral junction and left hypochondrium. A total gastrectomy was done with *en bloc* excision of omentum, spleen, stomach and its ligaments. The right colon was then mobilized beyond the hepatic flexure, some difficulty arising from fixation subsequent to the previous appendiceal surgery. The terminal ileum was divided 4 inches from the ileocecal valve, and the transverse colon was divided proximal to

FIG. 1. Case 1. Postoperative x-ray showing the capacity of the new reservoir. The haustral markings are well visualized. This film shows the dilatation of the segment and the retention of the greater portion of the barium meal.

the middle colic artery to form the segment for transposition. The right colic and ileocolic arteries were visualized and preserved for the blood supply to the transposition segment. A side-to-side ileotransverse colostomy was performed to restore continuity of the lower bowel. The terminal ileum was sutured end-to-end with the esophagus. The colonic edge of the segment was anastomosed to the duodenum, end-to-end, thus completing the transposition. With rotation and transposition it was seen that there was little or no tension on the anastomotic suture lines. The diaphragm was closed about the ileal portion of the segment using the original esophageal hiatus.

The patient tolerated the procedure quite well. Intubation of the colon segment during the first four postoperative days delivered 50 to 100 cc. daily of bile-stained fluid. Distention did not occur. Penicillin (800,000 units) and streptomycin (2 gm. daily in divided doses) were given during the first week. Complete parenteral alimentation was maintained for five days, liquids being given orally on the sixth day. This oral feeding was well tolerated

and quickly increased to a full diet before the end of the second week. He had definite hunger at meal times and was able to consume normal proportions of a full diet three times a day. On a few occasions he was desirous of second helpings which caused no difficulty. Repeat roentgen examination during the fourth week postoperatively showed excellent retention and slow emptying of the colon segment. (Fig. 1.) During this first postoperative month he gained 8 pounds, ate well and derived full satisfaction from his meals. Follow-up examination four months after surgery showed continued weight gain amounting to a total of 15 pounds. He had complained of occasional dysphagia which followed hurried eating of solid foods. This was not persistent and immediately responded to more careful attention to mastication. Esophagoscopy at this time allowed adequate visualization of the well healed anastomotic site without a stricture. The scope passed easily into the transposed segment. No evidence of tumor was seen.

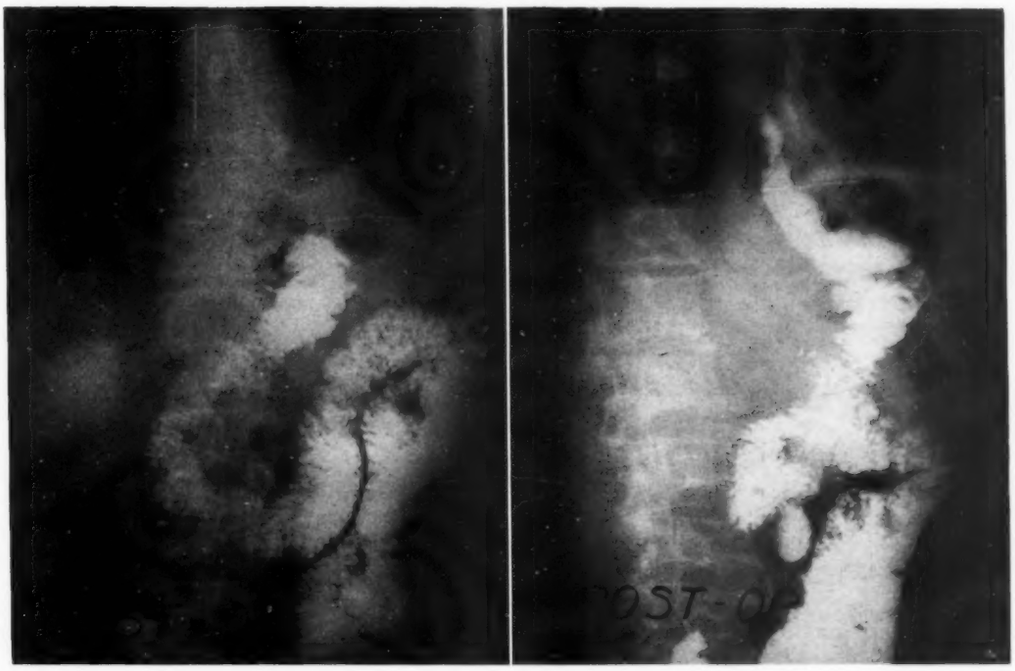
CASE II. Mr. M. M., was a fifty-seven year old white male who was admitted to the hospital November 11, 1951, with the chief complaint of persistent epigastric pain. It was first noticed in July, 1951, and resembled ulcer pain. It was relieved somewhat by food ingestion. He gradually developed marked anorexia, losing 40 pounds in weight. The pain became more severe and on admission he was able to eat only small amounts of food. On a few occasions vomiting had followed eating. There was no history of bleeding.

The physical examination showed a small, slightly tender mass palpable in the epigastrium. No anemia was present. The gastrointestinal series showed a marked, irregularly narrowed distal two-thirds of the stomach. Absence of peristalsis as well as mucosal distortion were noted in this segment. The duodenum was well outlined and appeared normal. A preoperative diagnosis of carcinoma of the stomach, linitis plastica in type, was made.

Surgery was undertaken on November 30, 1951. This patient had no preoperative preparation other than 3 gm. of aureomycin and cleansing enemas the day prior to surgery. It was believed that the lesion was probably inoperable; therefore, the abdomen was opened through a midline epigastric incision. There was complete involvement of the entire stomach by an infiltrating carcinoma. The stomach was quite small and its lumen contracted. The tumor extended into the gastrohepatic and gastrolienal ligaments as well as into the proximal portion of the greater omentum. There was also infiltration of the distal esophagus. The lesion was freely movable in all directions, however, and there was no gross evidence of lymph node enlargement or liver metastasis.

Total gastrectomy was decided upon and the dissection was accomplished without any technical difficulty. The incision was extended across the chondral junction and the chest entered through the ninth interspace. It was necessary to resect approximately 5 inches of the distal esophagus to grossly encompass this infiltrating lesion. After excision of the lesion the right colon was easily mobilized and the ileum divided 5 to 6 inches proximal to the ileocecal valve. The colon was divided at the hepatic flexure to form the segment for transposition. Here again, the ileocecal and right colic arteries were well visualized in the mesentery of this segment. An end-to-end ileotransverse colostomy was done to restore bowel continuity below. Appendectomy was done following which the right colon and ileum were rotated to their new positions. Anastomoses were then done, the ileum to the esophagus and colon edge to duodenum, both in an end-to-end fashion. The ends of the segment reached their required positions easily and there was no tension on the suture lines. The diaphragm was closed about the colon, the cecum being intrathoracic in position.

This patient also had no operative or anesthetic difficulties. Again, penicillin (800,000 units) and streptomycin (2 gm. daily in divided dosages) were given during the first week. The postoperative course was uneventful except for pleural effusion requiring thoracentesis on two occasions. Drainage from the Levine tube in the colon segment was similar in character to that of the previous case. It was somewhat less in amount. Liquids were started on the seventh day postoperatively and were increased to a full diet by the end of the second week. He was able to ingest full portions on a schedule of three meals a day. During the first six weeks he gained 14 pounds. He was able to eat regularly with no discomfort and derived satisfaction from his meals. Postoperative x-ray examination of this patient also showed good reception, retention and emptying of his barium meal. (Figs. 2 and 3.) Follow-up examination three



2 3

FIG. 2. Case 11. Postoperative x-ray showing the anastomosis between the colon segment and duodenum. An estimation can be made of the comparable lumen of the cut ends of colon and duodenum in relation to the feasible anastomosis.

FIG. 3. Same case. Postoperative x-ray showing filling of the new gastric segment with a portion of this segment in an intrathoracic position. This was necessitated by the longer esophageal resection.

months postoperatively showed the patient to be doing well although there was microscopic evidence of submucosal invasion by the malignant growth in the proximal cut end of the surgical specimen.

Experience with these two cases has led to general agreement with Dr. Lee's conclusions and the initial results are encouraging. The impressions gained from this experience are as follows:

1. The reservoir idea appears sound. The comfort of the patient is greatly improved in the immediate postoperative state over that of other procedures. The first patient early in his postoperative course offered the statement that he could eat every bit as well as he did before his illness. Both patients were able to eat relatively normal meals with definite satisfaction. Perhaps this may be more striking in these patients inasmuch as both suffered with severely disabling symptoms preoperatively. The future course of these patients will be followed with interest.

2. The esophagitis from reflux of intestinal contents which may occur with esophagojejunostomy has not been a factor in these gastrectomized patients. Esophageal pain has not occurred during the observation of these two cases. Reflux apparently is prevented partially by the interposition of the ileocecal valve. Reflux of the ileal contents, if this did occur, caused no difficulty.

3. Postoperative nutritional problems need not be as severe. At least the obviously increased oral intake which is permissible with this colon reservoir may allow easier control. Weight gain postoperatively might seem attainable more easily in this type of patient. Dumping symptoms, steatorrhea or diarrhea has not occurred.

4. The length of the terminal ileum chosen for transposition allows for an easier esophageal anastomosis and is a definite factor in lessening the dangers of tension at the anastomosis. When forced to resect the esophagus, the ileal segment may be carried up to reach the middle segment of esophagus as was done in the second case. Esophagojejunostomy by the Roux-Y principle would have been quite difficult in this second case after resection of the involved esophagus.

In this instance the replacement by the right colon and a long ileal segment seemed ideal.

5. Previous appendectomy does not have to constitute a contraindication to this surgical procedure. It did make the operation somewhat more difficult, but its accomplishment was not unduly prolonged.

6. The operating time for both cases was not excessive, being six and six and a half hours, respectively, for Cases I and II. In both cases it may compare with the time required for total gastrectomy and esophagojejunostomy. Both patients did well during and immediately after surgery.

7. Postoperative distention of the new gastric reservoir was negligible. Intubation in both cases delivered minimal amounts of air or fluid from the segment. It might be possible to institute earlier feedings through the nasal tube in future cases.

8. In regard to palliation with this procedure opinion may well vary as it does with the question of palliation in any type of cancer surgery. Certainly, it would seem to be applicable in some few cases of incurable gastric carcinoma. In view of the temporary comfort of the second patient in whom residual tumor is no doubt present, it would seem that the surgery was of value to that patient. Future follow-up is necessary to determine this point.

SUMMARY

Two cases of total gastrectomy with replacement of the excised stomach reservoir by transposition of the right colon and terminal ileum are presented. The initial response of both patients in adjusting to an early normal food intake was good. The principle of interposing transverse colon or terminal ileum and right colon seems feasible and sound. Full evaluation cannot be made without more reported cases and longer follow-up examinations. It may offer many advantages over presently employed esophagojejunostomy.

REFERENCES

1. LAHEY, F. H. Total gastrectomy for all patients with operable cancer of the stomach. *Surg., Gynec. & Obst.*, 90: 246–247, 1950.
2. LAHEY, F. H. and MARSHALL, S. F. Should total gastrectomy be employed in early carcinoma of the stomach? *Ann. Surg.*, 132: 540–565, 1950.
3. LEE, C. M., JR. Transposition of a colon segment as a gastric reservoir after total gastrectomy. *Surg., Gynec. & Obst.*, 92: 456–465, 1951.
4. MACDONALD, R. M., INGELFINGER, F. J. and BELDING, H. W. Late effects of total gastrectomy in man. *New England J. Med.*, 237: 887–896, 1947.
5. STATE, D., BARCLAY, T., KELLY, W. D. Total gastrectomy with utilization of a segment of transverse colon to replace the excised stomach *Ann. Surg.*, 134: 1035–1041, 1951.

# A MORE IDEAL APPENDECTOMY INCISION*

CHARLES G. FRASER, M.D.
*Tucson, Arizona*

WHEN McBurney[2] in 1894 first introduced a muscle-splitting incision for removal of a quiescent appendix, surgeons were then discarding the median linea alba incision for a vertical incision at the outer edge of the rectus muscle or at some point between this muscle and the anterior superior spine of the ilium.

In his earlier operations McBurney made an incision parallel with and near the right edge of the rectus muscle. He did not continue using this incision because it was often too medially placed for easy exposure of the appendix. Others abandoned this incision because of the tendency for herniation.

He later described an oblique skin incision 4 inches long. The external oblique aponeurosis was merely separated. The internal oblique and transversalis muscles were not split, as in his later operation, but cut across at a right angle. This incision gave adequate exposure but here, too, hernias were common for the nerves were severed.

McBurney then finally arrived at his muscle-splitting incision for which he is famous today. This incision avoided the frequent postoperative hernias which had plagued surgeons. His operation, with but minor modifications, has been the accepted method of appendectomy through these fifty odd years.

It is interesting to note that McBurney had performed the muscle-splitting incision but four times when he first published his method. These were interval appendectomies and he believed this operation was not suitable for suppurative cases. He did not consider it an easy operation and stated it required two extra assistants to hold retractors.

Weir[3] in 1900 applied the basic muscle-splitting incision beyond the bounds of a quiescent appendix, as wisely limited by McBurney, to include acute appendicitis. He gained added exposure by cutting the rectus muscle sheath transversally in line with the split internal oblique and transversalis muscle and then by retracting the rectus muscle medially after ligating the epigastric vessels on the posterior sheath. This widely practiced procedure has been known as the Weir extension. It has been a sound maneuver and has avoided herniation.

There have been numerous modifications of the McBurney incision. In the author's opinion the most noteworthy is one described by Elliot[1] in 1896. He employed McBurney's incision for easy cases but objected to the necessity of hard and constant retraction to expose more difficult cases. He also disapproved of an extended incision, stating that it left a ragged and complicated wound with two muscular layers stripped widely apart.

To meet these objections he began his operation by making a horizontal cut through the skin and aponeurosis of the external oblique, beginning ½ an inch inside the anterior superior spine of the ilium, and extending to the linea semilunaris. The fibers of the external oblique are thus cut across, but the fibers of the internal oblique and transversalis are separated as in the McBurney operation. The whole incision is cross cut, the external and internal incision running in the same direction.

Without previous knowledge of Elliot's publication, the author in a search for more satisfactory exposure of the inflamed appendix devised an operation almost identical to that of Elliot's. The advantages of this incision are that it is cosmetic; it avoids cutting nerves and thus prevents herniation; it gives exposure in depth equal to that of the surface, a distinct advantage over the McBurney incision in this respect; the bowel is less traumatized because of added exposure in depth; the incision is ideal for further extension of the wound if

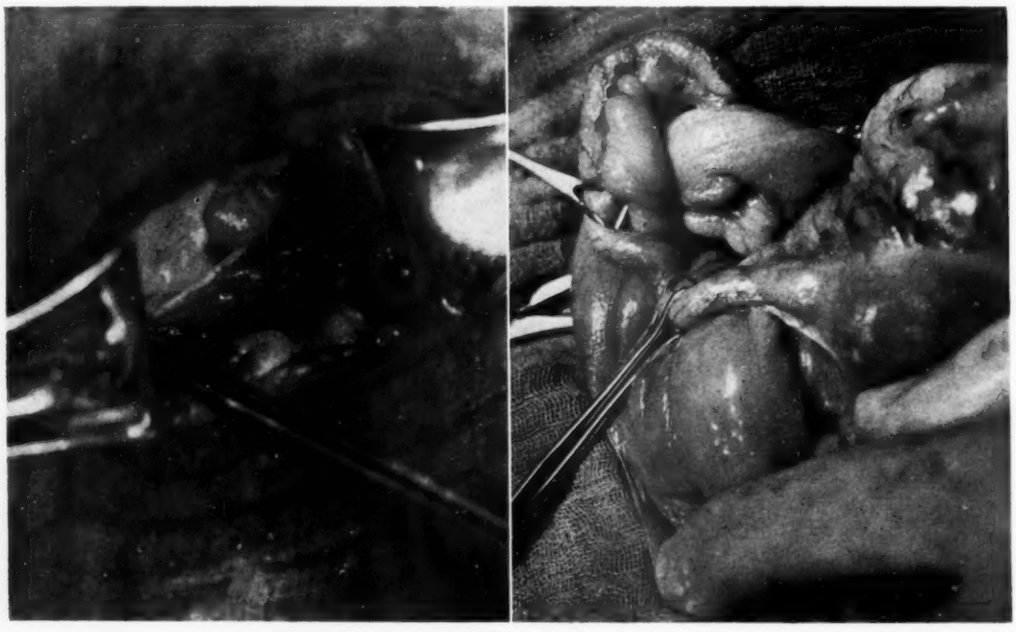
* From the Veterans Administration Hospital, Tucson, Ariz. Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the author are the result of his own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

1 2 3

FIG. 1. The incision is placed along the skin lines over the appendix and extends from above and medial to the anterosuperior iliac spine across to the lateral edge of the rectus sheath. The length varies with individuals.

FIG. 2. The external oblique aponeurosis is incised transversely in the line of skin incision and is seen retracting.

FIG. 3. The photo shows the internal oblique and transversalis muscle fibers severed in a transverse direction and in the line of skin incision.



4 5

FIG. 4. This demonstrates the transversalis fascia and peritoneum cut in the same transverse direction. The bowel is beginning to protrude through the wound.

FIG. 5. To demonstrate the increased exposure with this incision the cecum is brought up to lie freely on the surface.

necessary and undue retracting and tugging of the abdominal wall are avoided.

The author endorses and recommends a revival of the method as described by Elliot so long ago.

### AUTHOR'S PROCEDURE

The skin over the appendix medially and about 1 inch above the anterior iliac crest is incised transversely in the direction of the skin lines. (Fig. 1.) The external oblique aponeurosis is cut across in the *same direction as the skin incision* (Fig. 2), here differing from the usual muscle-splitting incision. The internal oblique and transversalis muscles are then split in the direction of their fibers and in the same line as above. (Fig. 3.) Occasionally some of these fibers may not run transversely and they may be cut across, keeping all incisions in this same line. The transversalis fascia and peritoneum are finally cut in the same direction as the skin and muscles. (Fig. 4.) This incision is best

likened to taking a knife and cutting all structures of the abdominal wall in the same direction and in one plane.

If further exploration and exposure are necessary, this incision is ideal for its conversion into a complete transverse incision by cutting across the anterior rectus sheath, the rectus muscle and posterior rectus sheath as indicated.

The advantage of this incision over the usual muscle-splitting incision is the added exposure obtained in depth by eliminating the bowstring effect of the external oblique. The cecum can be more easily mobilized and readily brought up to lie so freely on the surface that the appendix can be handled without even maintaining traction on the abdominal wall. (Fig. 5.) Trauma to the bowel is diminished because of the ease of exposure.

No objections to cutting the external oblique aponeurosis have been found. The repair is just as simple and as sound as the muscle-splitting incision, using interrupted non-absorbable sutures in the muscles and fascia. No hernias have developed since using this incision exclusively over a period of three years.

*Acknowledgment:* The author is indebted to Dr. William J. Norris of Los Angeles for his help in preparing this paper.

REFERENCES

1. Elliot, J. W. A modification of the McBurney incision for appendectomy. *Boston M. & S. J.*, 135: 433, 1896.
2. McBurney, C. The incision made in the abdominal wall in cases of appendicitis, with a description of a new method of operating. *Ann. Surg.*, 20: 38, 1894.
3. Weir, R. F. An improved operation for acute appendicitis or for quiescent cases with complications. *M. News*, 76: 241, 1900.

# ATTEMPTED TRANSPLANTATION OF FETAL THYROID IN A CASE OF MYXEDEMA*

WALTER J. BURDETTE, M.D.
*New Orleans, Louisiana*

THE similarity of malignant and embryonic tissues in potentiality for growth in heterologous transplants has been emphasized by Greene.[1] Smith[3] and Rous have transplanted fetal tissues with carcinogens in mice and found the latent period for tumorigenesis to be very brief, and Krementz[2] has reported functioning of transplanted thyroid tissue in the anterior chamber of the rabbit's eye. The possibility that homologous grafts may survive in the human when fetal tissues are transplanted deserves investigation in view of these findings. If, in addition, the donor tissue would function, the possibilities for therapeutic application are considerable particularly in the case of the endocrine glands.

Thyroid tissue was obtained from a fetus of twelve weeks of age at the time of hysterectomy in a patient with toxemia. A white female sixty-four years of age with myxedema of long duration was selected as the recipient. Under aseptic conditions 50 mg. of fetal thyroid was transplanted into the left rectus muscle 1 cm. above the umbilicus and the wound was closed with interrupted sutures of cotton. The operation was performed uneventfully with local procaine anesthesia and the patient recovered without any complications.

Four weeks after operation 40 $\mu$c. of $I^{131}$ were administered to the patient and the gamma irradiation measured with an end-window Geiger-Mueller tube in twenty-four hours. These studies indicated that the graft either did not take up iodine or did so in amounts insufficient for detection. The patient was in early cardiac failure at this time and it was judged unwise to withold conventional therapy for a longer period. It has now been six months since the tissue was transplanted and there is still no evidence of growth.

The recipient of the graft had had three doses of thyroid extract during the week prior to operation which may have influenced the results. Also in this case there is some evidence that slight residual function was still present in the patient's thyroid in spite of the clinical findings. Although the grafting was unsuccessful, this method of approach deserves complete evaluation and the experience obtained in this case may be useful to others who are interested.

SUMMARY

Thyroid tissue from a twelve week fetus was transplanted to the rectus muscle of a sixty-four year old female with myxedema. Four weeks later no evidence of function was found when $I^{131}$ was administered to the patient. The method deserves further evaluation.

REFERENCES

1. GREENE, H. S. N. A conception of tumor autonomy based on transplantation studies: a review. *Cancer Research*, 11: 899, 1951.
2. KREMENTZ, E. T. A functional homologous embryonic thyroid transplant in the rabbit. A preliminary report. *S. Forum Am. Coll. Surg.* Philadelphia, 1952. W. B. Saunders & Co.
3. SMITH, W. E. The neoplastic potentialities of mouse embryo tissues *V*. The tumors elicited with methylcholantrene from pulmonary epithelium. *J. Exper. Med.*, 91: 87, 1950.

* From the Department of Surgery, Louisiana State University School of Medicine, New Orleans, La.

# Case Reports

## UTERINE MIXED TUMOR OF NINE YEARS' DURATION*

V. E. Chesky, M.D., W. C. Dreese, M.D. and C. A. Hellwig, M.D.
*Halstead, Kansas*

While mixed tumors of the salivary gland have a rather favorable prognosis,[1,2] the course of uterine mixed tumors is, as a rule, fulminating. The average duration of life after the onset of symptoms is six to twelve months, and no five-year survival has been recorded. However, we observed a patient with a mixed tumor of the uterine body who lived nine years after the histologic diagnosis had been made. Its clinical and histologic study over many years offers an unusual opportunity to evaluate the contradictory opinions on the nature of uterine mixed tumors.

### CASE REPORT

H. W., a fifty-four year old white married woman, was first admitted on November 24, 1942, because of vaginal bleeding of eight days' duration, low back pain and nervousness. In August, 1942, the patient had severe cramps in the lower abdomen with uterine bleeding which lasted three weeks. The bleeding stopped until November 16th when she again had severe pain and cramps in the abdomen with an excessive amount of bleeding, and large clots were passed. The patient had not ceased flowing since November 16th. The menopause had occurred five years previously, and the patient had always had good health until the present illness. She had no children and had had no abortions. There was no history of cancer in her family.

Physical examination was essentially negative except for moderate obesity and the presence of a movable, fist-sized, smooth mass in the vagina, protruding through the cervical os. At operation (V. E. C.) on November 26, 1942, a large, soft, friable, partly necrotic polyp which protruded from the cervix was removed. More tumor tissue could be palpated in the uterine cavity. From November 30th to December 5th the patient received deep

Fig. 1. First surgical specimen. Polypoid tumor weighs 72 gm. Reddish gray color and hemorrhages on surface.

roentgen therapy to the uterus (1,512 r). She was discharged from the hospital on December 8, 1942, and advised to return in one month for a total hysterectomy.

A gross description of the first surgical specimen (Fig. 1) follows: The polypoid tumor weighed 72 gm. and measured 10 by 8 by 4 cm. It had a coarsely lobulated, reddish gray and hemorrhagic surface. The cut surface varied from gray to reddish gray in color and was smooth and glistening. The consistency was soft.

Microscopically, most areas of the tumor were compact and very cellular. Some cells were spindle shaped with elongated nuclei and scanty cytoplasm, suggesting fibroblasts; others were large, round or oval, containing dark round nuclei. In some places the cells were stellate and loosely arranged, giving a

* From the Hertzler Clinic and Research Foundation, Halstead, Kan.

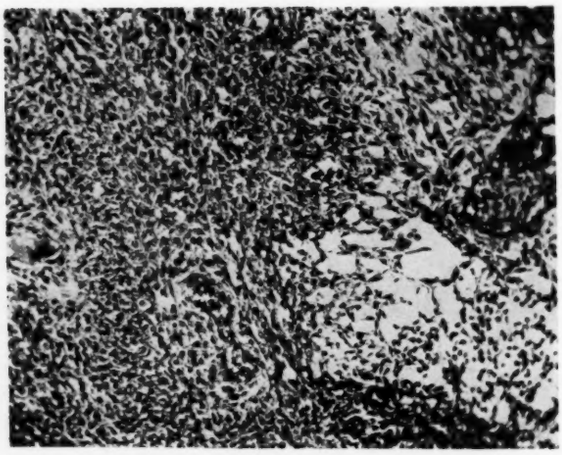


FIG. 2. Myxomatous and spindle cell sarcomatous stroma. × 140.

myxomatous appearance. (Fig. 2.) On the surface, dipping down into the mass, were clefts lined with one or several layers of high cuboid cells. (Fig. 3.) There were no mitoses seen in these epithelial cells. Embedded in the sarcomatous stroma were several clusters of large squamous cells, which were remarkably differentiated and were arranged concentrically. Their cytoplasm stained red. The squamous cells appeared to originate within the stroma, showing all transitions to the sarcomatous spindle cells. (Fig. 4.) No striated muscle cells could be found, and there were no islets of cartilage or bone. In some of the sarcomatous areas structures resembled Stout's description of hemangiopericytoma. (Fig. 5.) Here the elongate cells, having the appearance of unstriated muscle cells, seemed to be growing out of vascular walls, and some concentrically arranged nodules had a vascular lumen suggesting tumor cells lying within a greatly thickened vascular wall. (Fig. 6.) The histologic diagnosis was uterine mixed tumor with glandular and squamous epithelium.

After operation and radiation treatment the patient had no bleeding and refused to have a complete hysterectomy. On January 27, 1943, she re-entered the hospital, and examination revealed a large tumor which filled the entire pelvis. At operation on January 28, 1943, (V.E.C.) a pseudomucinous multilocular cyst of the right ovary, the size of a cantaloupe, was removed. The left ovary was atrophic and the uterus did not show any pathologic changes.

A gross description of the ovarian cyst follows: The specimen preserved in formalin was spherical and had a diameter of 13 cm. The surface was glistening and grayish blue in color. There were no papillary elevations on the surface. Cross section revealed a large cavity containing thick mucoid fluid. Most of the cyst wall was 1 or 2 mm. thick, and smooth. There were many high trabeculae on the internal surface. On one side a nodular mass, 9 by 8 by 5 cm. was protruding into the cyst cavity and the cross section showed several daughter cysts between 1 cm. and 4 cm. in diameter, which contained thick, mucoid fluid. In several cysts low papillary elevations of the wall were seen.

Microscopically, the lining of the cyst wall consisted of columnar cells in a single row. The nuclei were basal, oval, dark stained and of uniform size. The cell body was swollen and filled with mucoid fluid. In several places glandular areas were found in the fibrous cyst wall. They were also composed of regular epithelium. The histologic diagnosis was multilocular pseudomucinous ovarian cyst.

The patient was not seen again until nine years later. On March 3, 1951, she entered the hospital with a history of daily spotting of bright red blood for six months and pain across the lower abdomen and in the back. On physical examination of the patient, now sixty-two years of age, moderate obesity and pallor of the skin were noted. In the vagina a lobulated, grape-like mass of tangerine size presented itself. It protruded through the external os of the cervix and bled on touch. The uterus was about twice the normal size. No tumor could be palpated in the adnexal regions. Proctoscopic examination revealed stenosis of the rectum caused by a nodular protrusion of the anterior rectal wall. There was normal mucosa at the surface, and it was the impression that a pelvic mass involved the anterior wall of the rectum from the outside.

On March 7, 1951, under spinal anesthesia, the mass protruding from the cervix was found to be attached to the posterior uterine wall. It was removed by clamping and cutting the pedicle. The inside of the uterus was examined digitally, and it was believed that there was still a large mass of tumor in the uterine cavity. The patient received deep x-ray therapy from March 10th through March 17th (2,304 r). Since she did not give her consent to a radical abdominal operation, she was discharged on March 17, 1951.

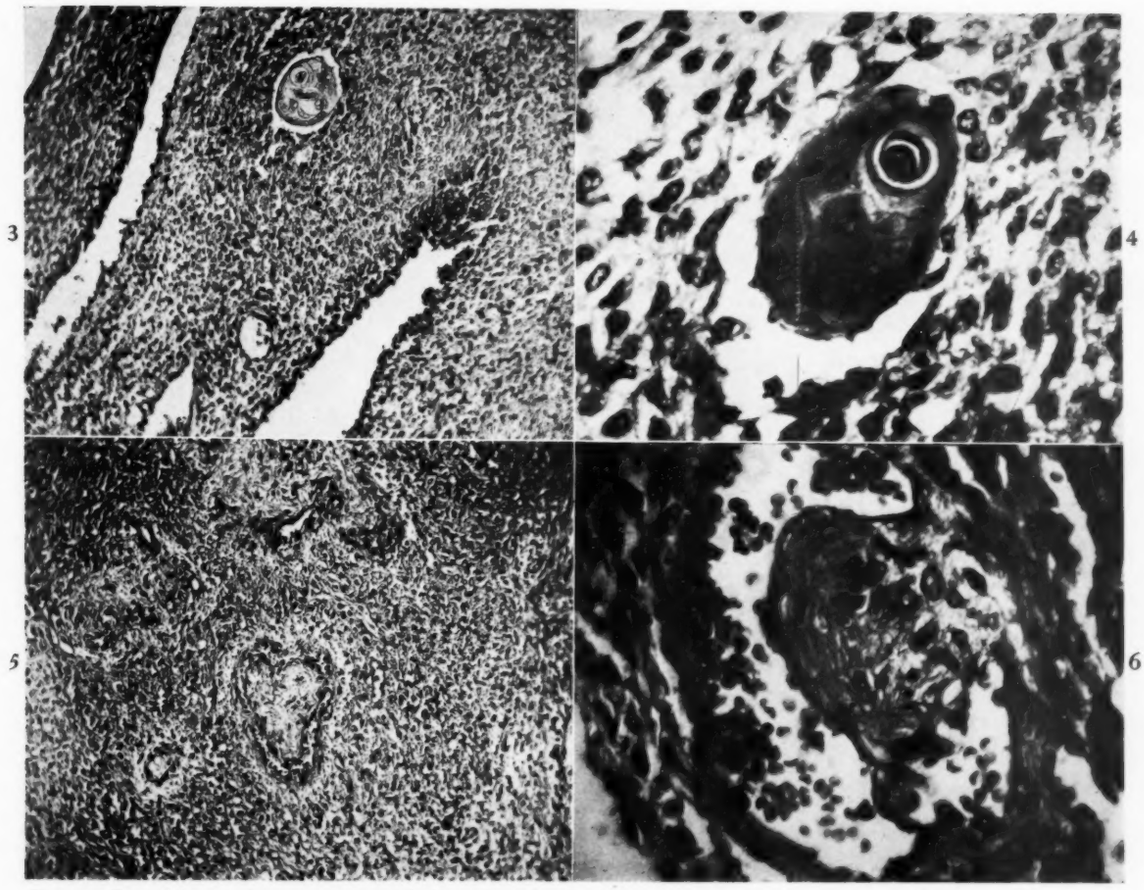



FIG. 3. Glandular and squamous epithelium in mixed tumor. × 140.

FIG. 4. Nest of squamous cells in embryonal myxomatous stroma. The transition of stroma cells into squamous cells is evident. × 580.

FIG. 5. Area of mixed tumor resembling pericytoma. × 140.

FIG. 6. Tumor cells invading blood vessel. In spite of blood vessel invasion no metastases were noticed until nine years after removal of this tumor. × 580.

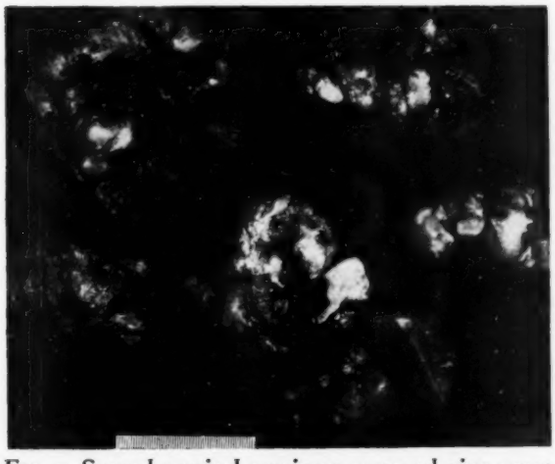


FIG. 7. Second surgical specimen removed nine years after first operation. Polypoid mass weighing 54 gm. × 140.

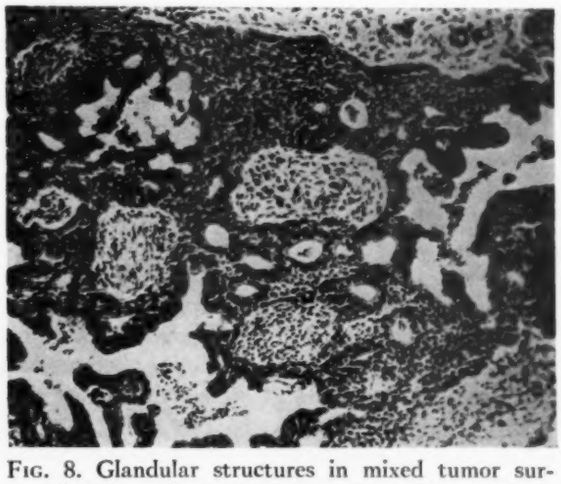


FIG. 8. Glandular structures in mixed tumor surrounded by embryonal myxomatous tissue. × 140.

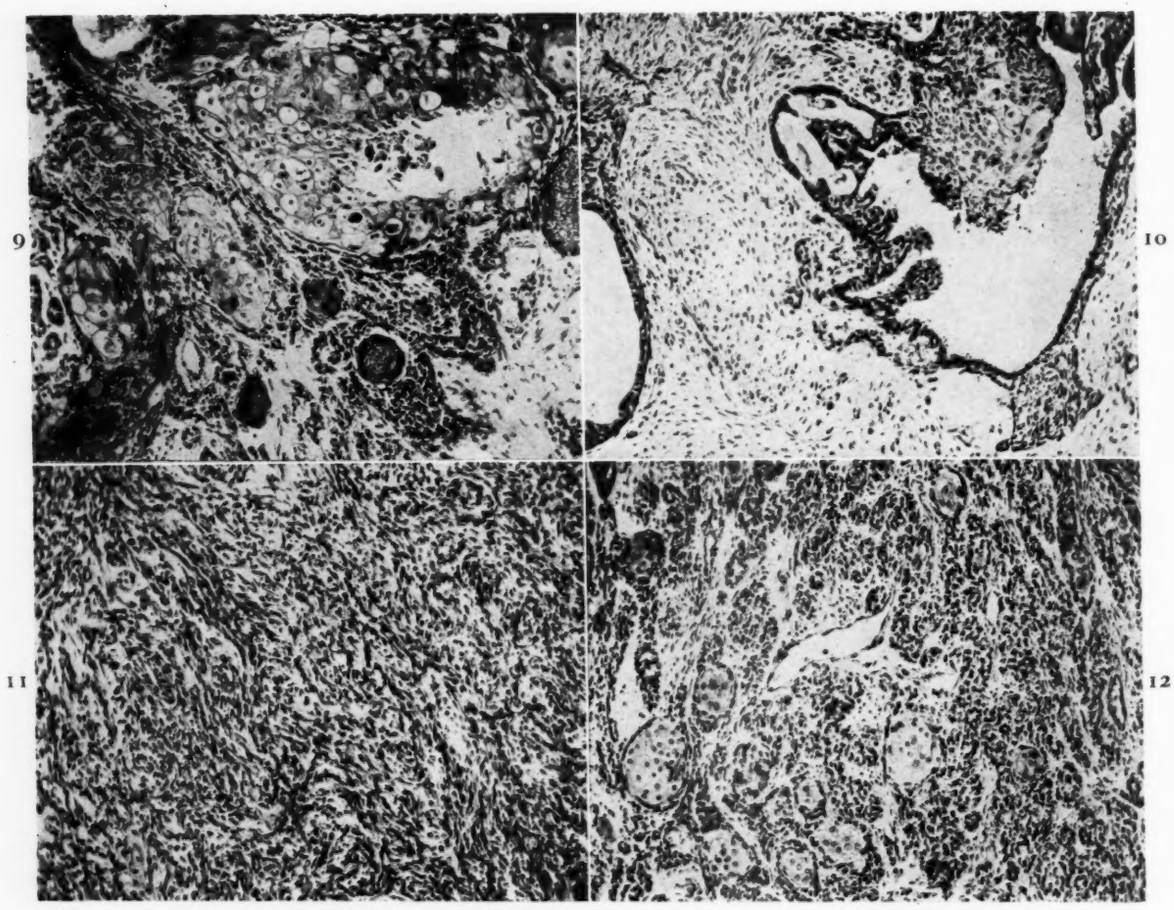



FIG. 9. Transition of glandular tissue and spindle cell stroma into squamous epithelium. × 140.

FIG. 10. Glandular spaces lined by cuboid and multilayered squamous epithelium. × 140.

FIG. 11. Densely packed spindle cell area in uterine mixed tumor. Rhythmic structure of nuclei. × 140.

FIG. 12. Transition of undifferentiated embryonal tissue into squamous epithelium. × 140.

A gross description of the second surgical specimen (Fig. 7) follows: The weight of the surgical specimen was 54 gm. There were two small pieces measuring between 3.5 and 2.5 cm. and one larger piece 5 by 4.8 by 2 cm. The tumor was a polypoid growth. The surface was nodular and the consistency was soft. On cross section the growth was found to be predominantly pink to pinkish gray and mottled with many irregular, soft friable, opaque yellow to brown areas and many small areas of fresh and old hemorrhage. There were numerous irregular, smooth, translucent myxomatous areas; no bony or cartilagenous tissue could be recognized.

Microscopically, a large number of paraffin sections from different parts of the tumor and at various levels were prepared. The growth was composed of a wide variety of elements among which myxomatous tissue and compact sarcomatous tissue formed the essential matrix.

Glandular structures strongly resembling endometrial glands were frequently incorporated within the substance of the tumor. (Fig. 8.) Irregular in outline and dimension, they were lined by one or several layers of medium to low columnar epithelial cells. In several glands transitions from columnar to squamous epithelium were seen. (Figs. 9, 10.) A striking feature was the presence of embryonal myxomatous tissue. It consisted of triangular or stellate-shaped cells with long delicate protoplasmic strands. In some areas myxochondroid tissue, with the typical staining reaction of the matrix, was noticed; the cells were clear, slender, and the nuclei dark stained.

Many portions were composed of densely

packed spindle cells with scanty collagenous fibers. (Fig. 11.) Mitotic figures were seen frequently. Of great interest was the transition of spindle cells into squamous cells. (Fig. 12.) The latter formed round nests and long strands. The squamous cells were well differentiated showing very little atypia and no mitotic figures. The surface of the polyp was partly covered with several layers of squamous cells which showed a tendency to invade the sarcomatous stroma and to form horn pearls. Myofibrils with cross striation, osseous or mature cartilagenous tissue could not be found in spite of a diligent search of many sections. Histologic diagnosis was uterine mixed tumor with glandular and squamous epithelium (carcinosarcoma).

The patient returned to the clinic on June 12, 1951. She was getting along well; pelvic examination revealed a small eroded area on the cervix which bled to touch but did not feel hard. The uterus was of about the same size as at the last operation, three months previously. The patient did not return for further follow-up in the clinic. Early in December, 1951, she died from local recurrence and abdominal metastasis of the uterine tumor, according to information received from her family physician. No autopsy was performed. Death occurred nine years after the histologic diagnosis of mixed tumor of the uterus had been established.

## COMMENTS

*Clinical Findings.* Glass and Goldsmith,[3] after reviewing ninety-four cases of uterine mixed tumors, state that these neoplasms are malignant out of all proportion to their histologic appearance. The mortality rate is 90 per cent regardless of therapy, and the average duration of life following removal is one-half to one year. The longest period of survival was recorded by Gamper,[4] whose patient survived four and a half years. According to Piquand[5] one in every 7,500 malignant tumors of the body of the uterus is a mixed tumor. Most of the mixed tumors were polypoid and originated from the anterior or posterior wall of the uterus. Metastases were most often local, infiltrating the parametria, vagina and peritoneum, although distant metastases in pleura, lung and lumbar lymph nodes have been described.

Our case is interesting because of the unusually long time of survival. The first symptoms, bleeding and pain, started in August, 1942, at the age of fifty-four, five years after the menopause. Three months after the onset of the disease a uterine tumor was locally removed. It was composed of myxomatous and spindle cell sarcomatous areas, myoblastic and angioblastic structures, as well as glandular and squamous epithelial elements. Two months after the uterine operation a large mass developed in the abdomen which at operation proved not to be a metastasis as was suspected, but a benign pseudomucinous ovarian cyst. The patient was clinically well for eight years. Late in 1950, at the age of sixty-two, uterine bleeding and pain recurred, and at operation in March, 1951, a large uterine polyp was removed. It showed the same myxomatous, and spindle cell, sarcomatous, angioblastic and myomatous structures as the primary tumor eight and a half years previously. There were, however, many more glandular and squamous cell elements present which showed malignant characteristics. The patient refused complete hysterectomy. In spite of intensive radiation treatment she died in December, 1951, with extensive local metastases, nine months after the second operation and nine years after the first.

*Pathology.* The majority of authors pay little attention to epithelial elements within the substance of uterine mixed tumors. R. Meyer[6] considers them to be merely a downgrowth of normal epithelium. That this is not always the case is shown by our own case as well as by two cases described by Charlewood and Murray.[7] The differentiation of the sarcomatous stroma into squamous cells and into glandular elements is plainly evident from our Figure 4 of the first specimen, and from Figure 12 of the second. Of greatest significance is the observation of Hill and Miller[8] who in their first case found histologic evidence of direct transformation of epithelial cells into cartilage, a very common occurrence in mixed tumors of salivary glands.

When Glass and Goldsmith surveyed the literature of uterine mixed tumors, 56.9 per cent of the corporeal mixed tumors were found to include epithelial elements. In eleven cases reported by Sternberg, Clark and Smith,[9] most of the mixed tumors had carcinomatous elements included. Wurtz[10] observed nineteen mesoblastic uterine and vaginal tumors in

which adenocarcinoma was the most frequent component.

Liebow and Tenant[11] accepted sixty-five tumors of the uterine body as mixed mesodermal, and epithelial portions were found in twenty-six. Lebowich and Ehrlich limited the authentic examples to thirteen, including their own. They demanded, however, cross striations in the rhabdomyoblasts for acceptability. Two cases incorporated in their report contained carcinomatous foci. Roemer[13] added one case; Neal, Horton and Dietrich[14] another. Sophian[15] included one and possibly two other mesodermal mixed tumors with malignant epithelial elements, all without cross striation. Hill and Miller recently published a report on four cases believed to be true carcinosarcomas.

*Histogenesis.* The origin of uterine mixed tumors is still a matter of dispute. At present there are two prevailing theories, namely, those of Pfannenstiehl[16] and Wilms.[17] Pfannenstiehl advanced the conception that the series of heterologous elements present in mixed tumors is derived from normal connective tissue of the uterine mucosa by a process of metaplasia. This theory has only Willis,[18] Nicholson,[19] and Sternberg as adherents today. Metaplasia can account for the development of smooth muscle, cartilage and bone from mesenchymal tissue, but the theory fails to explain the origin of squamous and glandular elements from the undifferentiated cells as plainly shown in our case, as well as in those of Hill and Miller; the latter also found evidence of transition of epithelial cells into cartilage.

It hardly seems reasonable that a physiologically and morphologically ripened tissue—like uterine stroma—can dedifferentiate into such diverse tissues as muscle, cartilage and epithelium. The theory proposed by Wilms and most forcefully propagated by McFarland[20] is the best offered so far.

Wilms' modification of Cohnheim's theory presumes the displacement and inclusion of mesodermal elements in the early formation and downward growth of the Müllerian ducts. The heterotopic cells remain dormant for a variable period until some growth stimulus causes them to proliferate. The complete absence of such mesodermal tumors along the course of the fallopian tubes or in the broad ligaments indicate that the genesis is definitely related to the embryologic process of organoid fusion in the caudal portion of the Müllerian ducts. The strength of the Müllerian duct theory lies first in the location of the tumor, as a rule in the anterior or posterior axis of the corpus uteri where the fusion of the Müllerian ducts has taken place, and the second in the presence of embryonal myxomatous tissue. It is the common mother tissue from which, on the basis of morphologic evidence, not only all the different stromal elements but also the epithelial structures of mixed tumors are derived.

These primitive cell rests retain their pluripotential capacity for differentiation into varied mesodermal tissue. These tumors on occasion may be simple in structure representing a unilateral type of differentiation. They may be benign as in a lipoma of the uterus; more frequently they are complex in tissue composition and are malignant in behavior. The unusual clinical behavior in our tumor, which remained dormant for eight years and developed finally into the most fulminating type of uterine mixed tumors, finds its analogy in other dysontogenetic tumors; for instance, bulky chorionepitheliomas have been described as arising from benign looking testicular teratomas which have remained quiescent for many years.[21–24]

## SUMMARY

1. A case of uterine mixed tumor with an unusually long time of survival is presented.

2. The surgical specimens removed at the onset of the disease and nine years later were both characterized by epithelial elements as well as by heterologous stromal tissue. Our histologic study suggests that in uterine mixed tumors not only the stromal but also the epithelial elements are derived from embryonal myxomatous tissue.

3. The clinical and histologic features of our case support Wilms' cell rest theory of mixed tumors.

*Acknowledgment:* We are greatly indebted to Dr. A. C. Broders, Temple, Texas, Dr. A. Plaut, Topeka, Kansas, and Dr. W. H. Sternberg, New Orleans, Louisiana, for their valuable opinions as to the diagnosis of this tumor.

## REFERENCES

1. Anderson, R. Cancer of the face and mouth. *Cleveland Clin. Quart.*, 19: 33, 1952.
2. Hellwig, C. A. Mixed tumors of the salivary gland. *Arch. Path.*, 40: 1, 1945.

3. Glass, M. and Goldsmith, J. W. A review of 94 mixed mesodermal tumors of the uterus. *Am. J. Obst. & Gynec.* 41: 309, 1941.
4. Gamper, R. Beitrag zur Kenntnis der mesodermalen Mischgeschwülste des Uterus. *Arch. f. Gynäk.*, 129: 878, 1927.
5. Piquand, G. Le sarcoma de l'uterus. *Rev. de gynéc.*, 9: 387, 1905.
6. Meyer, R. Uterus und Tuben. Anatomie u. Histologie. Berlin, 1930. J. Springer.
7. Charlewood, G. P. and Murray, J. F. Mixed tumors (botryoid sarcomata) of the uterus with 3 case reports. *South African J.*, 24: 807, 1950.
8. Hill, R. and Miller, F. N. Combined mesenchymal sarcoma and carcinoma (carcinosarcoma) of the uterus. *Cancer*, 4: 803, 1951.
9. Sternberg, W. H., Clark, W. H. and Smith, R. C. Malignant mixed Müllerian tumor (mixed mesodermal tumor of the uterus). *Am. J. Path.*, 27: 756, 1951.
10. Wurtz, K. G. Mixed mesodermal tumors of the female genital tract. *Illinois M. J.*, 96: 264, 1949.
11. Liebow, A. A. and Tenant, R. Mesodermal mixed tumors of the body of the uterus. *Am. J. Path.*, 17: 1, 1941.
12. Lebowich, R. J. and Ehrlich, H. E. Mesodermal mixed tumors of the corpus uteri; report of a case with review of the literature. *Surgery*, 10: 411, 1941.
13. Roemer, H. Karzino-sarkom des Endometrium mid Knorpelibildung. *Zentralbl. f. Gynäk.*, 65: 1497, 1941.
14. Neal, M. P., Horton, C. E. and Dietrich, K. D. Carcinosarcoma of the uterus with report of a case. *Southern M. J.*, 43: 693, 1950.
15. Sophian, L. Malignant mixed tumors—adenosarcoma of the corpus uteri. *Surg., Gynec. & Obst.*, 69: 818, 1939.
16. Pfannenstiehl, J. Das Traubige Sarkom der Cervix Uteri. *Virchows Arch f. path. Anat.*, 127: 305, 1892.
17. Wilms, M. Die Mischgeschwülste. Leipzig, 1899, A. Georgi.
18. Willis, R. A. Pathology of Tumours. St. Louis, 1948. C. V. Mosby Co.
19. Nicholson, G. W. Multiple mesodermal mixed tumors of the uterus associated with pluricentric carcinomata. *Guy's Hosp. Rep.*, 69: 173, 1918.
20. McFarland, J. Dysontogenetic and mixed tumors of the urogenital region. *Surg., Gynec. & Obst.*, 6: 42, 1935.
21. Prym, P. Spontanheilung eines Bösartigen Wahrscheinlich Chorionepitheliomatösen Gewächses im Hoden. *Virchows f. path. Anat.* 265: 239, 1927.
22. Symeonidis, A. Zur frage der Extragenitalen Teratogenen Chorionepithelioma und der Chorionepitheliomähnlichen Geschwülste. *Zentralbl. f. allg. Path. u. path. Anat.*, 62: 177, 1935.
23. Craver, L. F. and Stewart, F. W. Unusual case of teratoma testis. *J. A. M. A.*, 106: 1802, 1936.
24. Hellwig, C. A. Medicolegal aspects of chorionepithelioma in the male. *Am. J. Clin. Path.*, 9: 504, 1939.

# CYSTOSARCOMA PHYLLODES (GIANT INTRACANALICULAR MYXOMA)*

DONALD E. ROSS, M.D.
*Los Angeles, California*

CYSTOSARCOMA phyllodes is the name most commonly applied to a relatively rare tumor of the breast. Other pseudonyms are giant intracanalicular myxoma, adenofibrosarcoma, intracanalicular adenofibroma, fibromyxoma, sarcoma proliferum, arborescens (J. Muller), fibroma papillare and polyposum intracanalicular. There have been only 229[1] cases of this entity reported in the literature to date. However, there must be a large number that have never been reported. We conclude that it is only relatively rare. It is important to keep it in mind so that costly errors in diagnosis and treatment may be prevented. A failure to recognize the condition might well lead to the mistaken diagnosis of inoperable malignancy when in reality this is a benign lesion except in rare cases. We also wish to add two new cases of our own plus five others from the records of the Queen of Angels Hospital.

As cystosarcoma phyllodes has been adequately described many times,[1–13] a brief review will suffice at this time. It originates in a fibroadenoma which may remain small and apparently innocuous for many years; then the tumor takes on a sudden rapid growth. Pregnancy and menstruation seem to exert the necessary stimulus for this accelerated growth, in some cases. These tumors become very large in size; the average of 111 cases was 7½ pounds, and they become as large as a man's head. Patients do not come early for treatment as there is no pain and no general debility in the earlier period. Later, however, pain does develop and is often described as lancinating in character. The tumor is well encapsulated and does not invade the skin; but eventually the tumor bursts through, leaving a wide ulcerating surface which bleeds easily and may admit infection. At this time, it is not uncommon to have general debility, loss of weight and a spiking temperature. The general shape of the mass is sometimes described as square with one point downward.

The color of the skin varies from normal to various shades of red, plum or blue. Often the veins over the breast are dilated and prominent. The breast is lobulated and these show variations in consistency. Some areas are fluctuating while others exhibit varying degrees of resistance. The tumor is well encapsulated and is not adherent to the skin. The nipple is not retracted.

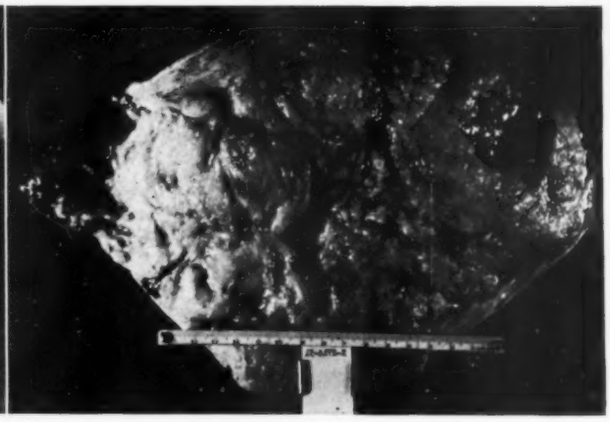
When the breast is cut open, the tumor is found to consist of huge, well encapsulated, intracystic polypoid masses with tortuous clefts which contain thin fluid ranging in color from yellow to brown. As enlargement proceeds, the polypoid masses tend to flatten and may completely fill the cystic spaces so that the tumor appears solid. The cut surfaces show great variation, having degenerating zones alternating with areas of solid tissue. Scattered throughout and constituting the majority of the solid parts of the tumor is a soft, semitransparent tissue. There is a strong capsule about the tumor and there is no invasion of the surrounding tissues.

Histologically, the tumor shows similar variations to the gross appearance. The close structural resemblance of the entire tumor to intracanalicular fibroadenoma is striking. Buds of connective tissue project for varying distances into slit-like spaces. The cystic spaces may have no epithelial covering but more frequently are lined by cuboidal cells. Some areas show a heaping up of epithelial cells with evidence of marked desquamation. Much of the stroma shows dense sheets of hyperchromatic spindle-shaped cells, the nuclei of which are small and dark staining. Dense masses of collagen may be seen scattered among myxomatous regions.

Cystosarcoma phyllodes is considered to be non-malignant and there have been many

* From the Department of Surgery, Ross-Loos Medical Group, Los Angeles, Calif.

1



2

FIG. 1. Note the huge size of the left breast in comparison with the right. The ulcerated area with fungating tumor is seen in the lower end. The lobulated appearance can be seen. The upper part shows large dilated veins on the surface.

FIG. 2. Note the general likeness to fibroadenoma showing the protuberances bulging into slit-like spaces. These are lined by low cuboidal cells. The cells in the interstitial spaces have darkly staining nuclei.

reports of cure by simple mastectomy. Yet, there have been a few cases in which the tumor has behaved in a malignant manner. A few have recurred locally. Hoffman[2] mentions a case in which this occurred twelve times with twelve operations. Death occurred from metastasis. An occasional instance of pulmonary[3] or osseous[4] spread is reported. White[13] reports one case with local recurrence, metastasis to the other breast and to the mediastinum and lung.

Cooper and Ackerman[15] report a case in which the muscle was invaded and there was metastasis to lymph glands. Local recurrence occurred in six months. Three months later another recurrence was noted and this time the tumor was found penetrating the chest wall.

## CASE REPORTS

CASE 1. Mrs. D. W. (No. 7035), a white multiparous woman, age fifty-one years, first noted a small firm nodule in her breast two years prior to surgery. This began to grow rapidly about six months before surgery and one month prior to surgery ulceration occurred. The patient stated that for the last six months the tumor mass had become markedly larger during her menstrual period. The breast swelled and became tense and discolored. It was during such a time that it seemed to burst at its lower extremity. Following this the patient had considerable blood drainage. Pain was quite acute and when seen by me the patient was spiking a temperature as high as 102°F. There had been considerable loss of weight, approximately 20 pounds.

The breast was huge. (Fig. 1.) It seemed as large as an adult head. The skin was plum colored and had many dilated veins running in the vertical direction. The lower end of the breast was ulcerated and the exposed tumor tissue bled easily. A radical mastectomy was performed on July 2, 1951, and a good recovery has been made. (Fig. 2.) The pathologic report was as follows (Figs. 3 and 4):

"Specimen consists of a huge left breast, with pectoral muscles and axillary structures attached. The specimen measures over-all 31 × 19 × 18 cms. The specimen is covered with a large, roughly elliptical piece of markedly attenuated skin which presents some lobulations. In approximately the mid-portion of the lower quadrant the skin has ruptured and some reddish-gray, partly mucoid tumor tissue protrudes from the rupture. This protruding mass of tumor measures approximately 6 cm. in maximum diameter. The nipple is compressed and is scarcely identified as such. The enlargement of the breast is due to a single huge almost spherical partly lobulated tumor mass measuring 26 cm. in maximum diameter. The cut surface of the tumor bulges, is predominantly grayish-white, shows irregular lobulations and several irregular pseudocystic areas of degeneration containing cloudy blood-tinged mucoid fluid. There are also multiple irregular slit-like formations between the irregular lobules of tumor tissue. A very small

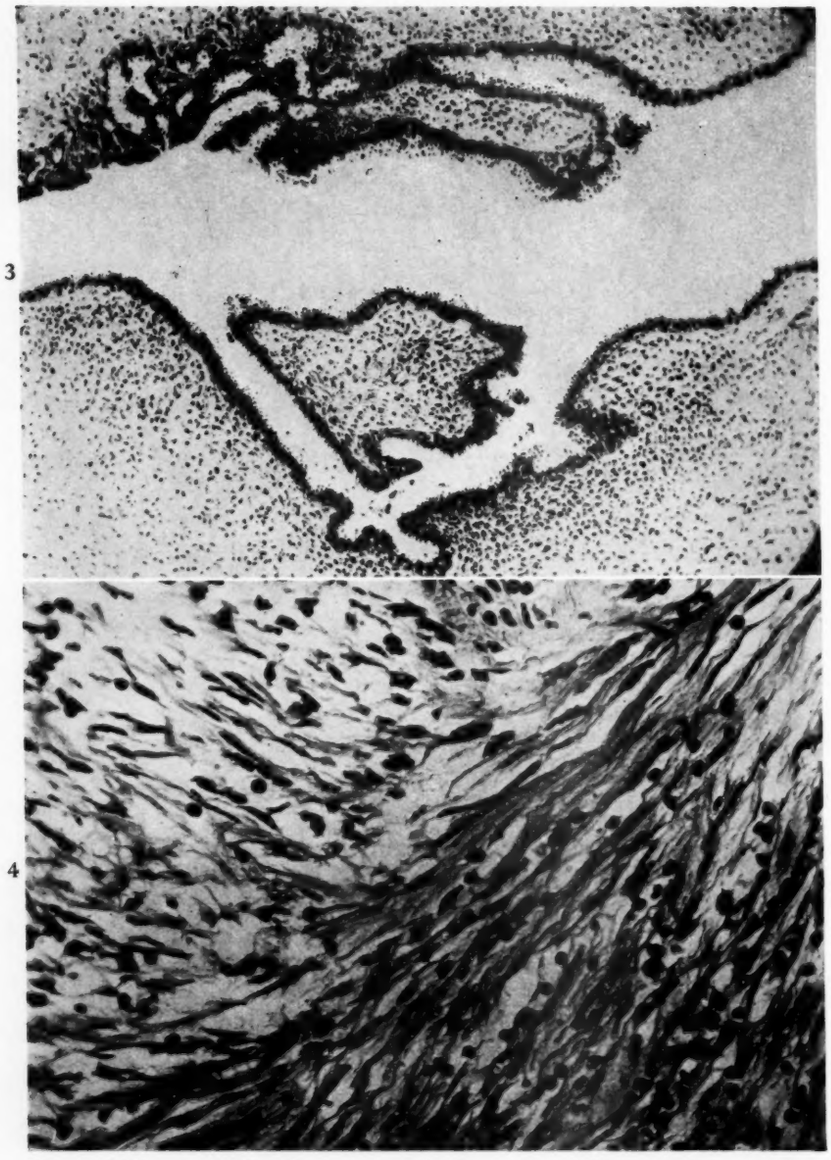


FIG. 3. Microscopically, the tumor again shows a resemblance to intracanalicular fibroadenoma. Buds of connective tissue project for varying distances into slit-like spaces. The spaces are lined by roughly cuboidal epithelium. The stroma shows hyperchromatic spindle-shaped cells, the nuclei of which are small and deep staining. Dense masses of collagen may appear between these cells and areas may appear myxomatous.

FIG. 4. A higher power shows the cells of the stroma. Many of these show nuclear changes which lead many observers to regard the tumor as potentially malignant.

amount of breast tissue is compressed at the periphery. Despite the enlargement of the tumor, the tumor is well circumscribed and appears to be encapsulated. Except for evidences of compression, the pectoral muscles show no noteworthy gross abnormalities. The axillary lymph nodes are neither enlarged nor firm. Sections are taken from representative ones for histologic study.

"Microscopical examination of 2 large representative sections of the huge breast tumor submitted for study shows in each of them an essentially similar histologic picture. There are scattered groups of ducts separated by abun-

dant, partly mucinous connective tissue stroma. The ducts are somewhat variable in size and shape. Many of them are dilated. Others are invaginated. They are lined with regularly arranged low columnar or cuboidal epithelium. In some of the smaller ducts, acidophilic fluid coagulum is found. The stroma is loosely arranged in some places, edematous and mucinous in appearance. In other areas it is richly cellular. The nuclei are somewhat variable in size and shape. Some are hyperchromatic and occasional mitotic figures are seen.

"The gross and histologic appearances of the tumor are consistent with a diagnosis of so-called cystosarcoma phyllodes, sometimes also referred to as giant intracanalicular myxoma. The general histologic pattern is essentially the same as that noted in fibroadenoma. There is no evidence of malignancy in the epithelial content. Evidences of low grade malignancy are noted in the connective tissue component of the tumor.

"Sections of the various lymph nodes selected for histologic study show no evidence of tumor metastasis.

"Diagnosis is made of huge cystosarcoma phyllodes of left breast (giant intracanalicular myxoma)."

Case II. Miss D. C. (No. 11975), fifty-three years of age, noted a hard place in the right breast three weeks prior to surgery. This was a mass in the upper outer quadrant about 3 cm. in diameter. On November 29, 1949, following a biopsy of the mass, a simple mastectomy was done. The specimen showed a definite cyst wall. The cystic spaces were filled with fluid. There were areas bulging into cystic spaces. The pathologic diagnosis was cystosarcoma phyllodes or giant intracanalicular myxoma. Following the simple mastectomy there were numerous small white fibroadenomas present.

Case III. Mrs. K. M. (No. 1398), sixty years of age, was admitted on February 16, 1943, to Queen of Angels Hospital under the care of Dr. W. Sullivan. Patient states that she noted two nodules in the right breast three months previously. The mass grew rapidly until it measured 11 by 5 by 2 cm. It was lobulated, unattached to the skin or deeper structures. The nipple was not retracted. The edges of the mass were well demonstrated. A simple mastectomy was performed and the pathologic diagnosis was adenomyomatosis. The stroma showed a low grade malignancy. There has been no recurrence to date.

Case IV. Mrs. A. G. (No. 2441), fifty-eight years of age, was admitted to Queen of Angels Hospital on March, 23, 1945, under the care of Dr. J. J. McDevit. The patient gave the history of a lump in the right breast for one year. At admittance, the lump was the size of an orange and was very painful. It was situated in the lower outer quadrant of the breast and was freely movable. The skin was not attached, the nipple was not retracted and there was no adhesion to the skin. There were no axillary lymph node enlargements. A simple mastectomy was performed. Grossly, the cut tumor mass measured 9 by 7 cm. The surface was glistening pale gray and had translucent strands of course fibrous tissue. The spindle cells in the stroma were somewhat malignant in appearance. A pathologic diagnosis was made of adenofibrosarcoma. There has been no recurrence to date.

Case V. Mrs. N. C. (No. 1124), sixty-three years of age, entered the Queen of Angels Hospital on February 7, 1947, under the care of Dr. J. Zeiler. She had a lump in each breast. The right breast had a lump first noticed about six months prior to admission. It was situated in the lower outer quadrant, seemed freely movable, not painful, was not attached to the skin and seemed encapsulated. The nipple was not retracted. The lump was removed locally and the pathologic notes stated that the condition resembled a fibrosing adenomatosis but had the appearance of a fibroadenoma. Many changes in the cells of the stroma indicated a malignant change in a pre-existing fibroadenoma. The left breast had Paget's disease of the nipple and a mass of duct carcinoma beneath the nipple. A simple mastectomy was done of the left breast and there has been no recurrence to date.

On August 5, 1951, the patient was readmitted to the hospital (No. 8369). There was a recurrence of the tumor in the right breast, first noticed about six weeks previous to the second admission. This time the patient had pain. The menopause was twelve years ago. The tumor was the size of a walnut, soft, tender and mobile. The nipple was normal and there was no axillary lymph node enlargement. A simple mastectomy was done on August 6th and the pathologic notes state that the tumor was 3 cm. in diameter, well circumscribed and

shows raised lobulations. The cut surface showed small cystic spaces into which papillary gray tissue protruded. The diagnosis was adenosarcoma, cystosarcoma phyllodes, intracanalicular myxoma.

CASE VI. Mrs. J. M. (No. 840), was admitted to Queen of Angels Hospital on January 28, 1947, under the care of Dr. W. Holleran. The patient stated that a lump developed thirty years ago while she was nursing her baby. She had had bleeding from the nipple for one month and then sought advice. The lump started as an abscess then became cystic or soft and finally a firm mass developed. Menopause was six years previous to admission. Recently, the breast had been tender and painful. The area around the nipple had been red and drained pus. The temperature on admission was 103°F. A simple mastectomy was performed on the day of admission. The pathologic report read as follows:

"An ovoid ulcerated area replaces the site of the nipple. The ulcer is deep and contains mucopurulent fluid. The external configuration of the breast is nodular, irregular, lobulated mass. The skin is adherent. The tumor measures 10.5 × 7 cms.

"The cut surface is pale gray, translucent and mucinous in appearance with multiple lobulated components. There are some hemorrhagic areas and other necrotic areas. Diagnosis is giant intracanalicular myxoma."

There has been no recurrence to date.

CASE VII. M. F. (No. 5348), a forty-six year old white, married woman, was admitted to Queen of Angels Hospital on May 17, 1951, under care of Dr. H. Koppelman. The patient first noticed a lump six months prior to admission. It had been painless and there was no increase in size. The mass was in the upper middle portion of the left breast. The tumor measured 14 by 13 cm. A cross section showed a predominantly firm grayish structure in which there were cystic spaces. Microscopic examination showed a variable picture. In one section there were numerous irregular closely grouped and very poorly differentiated tumor cells. These were apparently of epithelial origin. The tumor cells varied in size and shape. The nuclei were large, hyperchromatic and showed the various classic cytologic features of malignancy, including mitotic figures. The cytoplasm was abundant and vacuolated. There was a relatively small amount of stroma, most of which did not show any definite pattern. In other areas, the tumor resembled a fibroadenoma. The stroma here gave the appearance of sarcoma, being very cellular. Lymph nodes submitted for study showed no metastasis. The picture was that of a malignant tumor with dual histogenesis. Diagnosis was carcinosarcoma.

## SUMMARY

1. A brief review of the subject, cystosarcoma phyllodes, is made.

2. The tumor might easily be mistaken for inoperable malignancy. Its huge size with no metastases to lymph nodes or invasion of surrounding tissues marks it as a benign growth.

3. Pathologists frequently comment on the relatively malignant appearance of the stroma. Occasionally, too, these tumors act in a malignant manner, recurring locally and even metastasizing. For these reasons we believe that radical mastectomy should be performed rather than simple mastectomy.

4. Two case reports of the author are added, plus five cases extracted from the hospital records of the Queen of Angels Hospital since 1943 to the present time, 1952.

## REFERENCES

1. SMITH, C., JR., PARSONS, R. J. and BOGART, W. M. Giant intracanalicular fibroadenoma. *California Med.*, 75: 101–104, 1951.
2. HOFFMAN, A. Ein durch die grosse Zahl der Recidive, sowie durch einen ausnahmsweise langdauernden recidivfreien Intervall demerkenswerther Fall von Mammasarcom. *Arch. f. klin. Chir.*, 48: 93, 1894.
3. GRAVES, T. C. Mammary sarcoma in old age. *Brit. M. J.*, 1: 81, 1920.
4. BOLDREY, E. B. Primary sarcoma of breast, with report of 4 cases. *Canad. M. A. J.*, 35: 16, 1936.
5. BRODIE, B. C. Lectures on Various Subjects in Pathology and Surgery. London, 1846. Longmans Green & Co.
6. COOPER, A. Illustrations of the Diseases of the Breast, part 1, pp. 32–45. London, 1929. Longmans Green & Co.
7. HILL, R. P. and STOUT, A. P. Sarcoma of the breast. *Arch. Surg.*, 44: 723–759, 1942.
8. LEE, B. J. and PACK, G. T. Giant intracanalicular myxoma of the breast. *Ann. Surg.*, 93: 250–268, 1931.
9. MUELLER, J. Ueber den feinern Bau und die Formen der krankhaften Geschwuelste, Berlin, 1938. G. Reimer.
10. ROSE, J. Die Sarkome der weiblichen und die

Geschwülste der männlichen Brustdrüsen nach dem Material der chirurgischen Klinik zu Liepzig. *Deutsche Ztschr. f. Chir.*, 246: 151, 1936.
11. VELPEAU, A. Traite des Maladies due Sein et de la Region Mammaire. Paris, 1854. V. Masson.
12. WARREN, S. and MEYER, R. W. Lymph node metastasis of sarcoma. *Am. J. Path.*, 14: 605, 1938.
13. WHITE, J. W. Malignant variant of cystosarcoma phylloides. *Am. J. Cancer*, 40: 458–464, 1940.
14. WILLIAMS, W. R. Diseases of the Breast. London, 1894. John Bole & Sons.
15. COOPER, W. G. and ACKERMAN, L. V. Cystosarcoma phylloides, with a consideration of its more malignant variant. *Surg., Gynec. & Obst.*, 77: 279–283, 1943.

MUSTARD and Custer recently reviewed the management of over 200 cases of acute cholecystitis and reached the conclusion that operation can often be delayed. In fact, especially when the surgeon is only partially trained, it may be quite dangerous to the patient to perform immediate surgery in tissues that are markedly inflamed. In such cases the authors prefer to manage the patients conservatively, giving intravenous fluids, antibiotics, etc., and sending the patient home to convalesce. After this a non-emergency cholecystectomy can more safely and more satisfactorily be performed. Only when the infection continues to spread in spite of appropriate medical therapy do they advise an immediate operation—cholecystectomy if possible or cholecystostomy. (*Richard A. Leonardo, M.D.*)

# PRIMARY INTUSSUSCEPTION OF APPENDIX WITH ENDOMETRIAL IMPLANTS*

PAUL C. MORTON, M.D. AND CARL S. OAKMAN, M.D.
*New York, New York*

MANY thousands of patients pass through the operating rooms of the nation's hospitals for appendectomy each year; it is the rare case, however, whose pathologic entity proves to be intussusception of the appendix. Of the instigating causes for appendiceal intussusception, endometriosis of the appendix is one of the least common. The purpose of this article is to present a case report of complete primary appendiceal intussusception with gangrenous appendicitis and endometrial implants in the wall of the appendix.

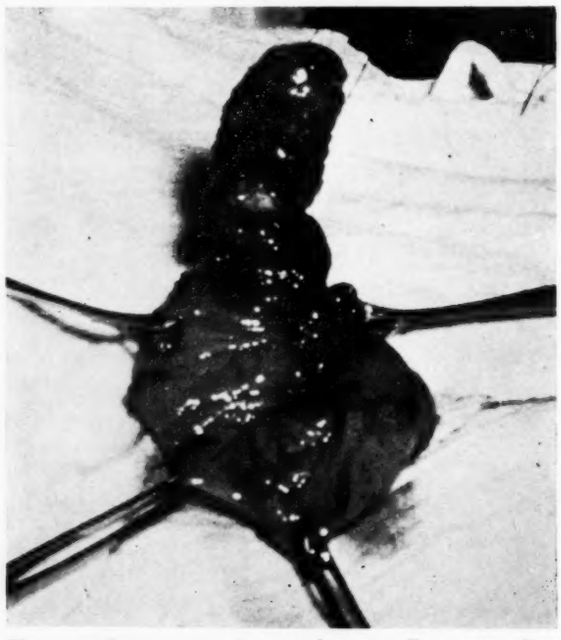


FIG. 1. Gangrenous inverted appendix protruding into cecum.

*Present illness:* M. K., a thirty-nine year old white woman, presented herself for examination at St. Luke's Hospital, New York City. The patient gave an eighteen-hour history characterized by sudden onset of severe crampy periumbilical pains accompanied with several attacks of vomiting. Temporary relief was secured with the use of paregoric and sedatives administered by her family physician. With the return of pain, hospital evaluation was requested.

*Past history:* For approximately one and a half years prior to her present episode, the patient had suffered crampy periumbilical pains similar to her presenting complaint. These pains would persist for two or three hours and then subside. There had been similar attacks of pain associated with approximately twelve of her menstrual periods, but never of the severity or persistence of the present attack. The patient had never been pregnant and the remainder of her past history was noncontributory.

*Physical examination:* Patient had a persistent non-productive cough. There were rhonchi throughout both lungs consistent with her story of a recent respiratory infection. Although the patient no longer complained subjectively of pain, examination of the abdomen revealed a vague suggestion of tenderness in the right lower quadrant with no specific localization and no spasm. Pelvic and rectal examinations were negative.

*Laboratory examination:* White blood count was 13,400; polymorphonuclear leukocytes 73 per cent; lymphocytes 25 per cent; monocytes 2 per cent; rectal temperature 100.4°F.

*Hospital course:* Although the patient was admitted with a diagnosis of possible acute appendicitis, she continued to feel well throughout the following day with disappearance of abdominal pain. The presence of chest symptoms and persistent rales, together with slightly elevated temperature and disappearance of pain, suggested a diagnosis other than appendicitis as the etiologic factor. On the third hospital day, however, the right lower quadrant tenderness reappeared and localized at McBurney's point with a white blood count of 9,000 (poly-

* From the Department of Surgery, St. Luke's Hospital, New York, N. Y.

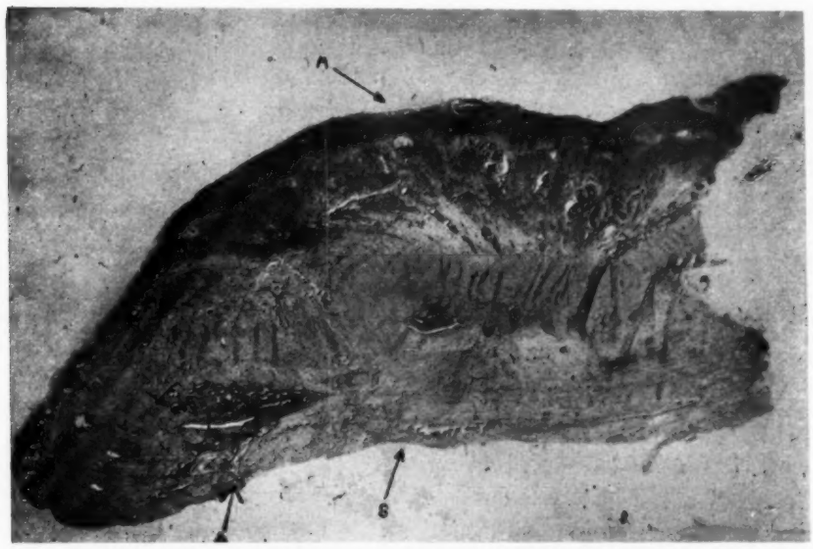



FIG. 2. Low power: full thickness of appendix wall. M, mucosa; S, serosa; A, endometrial implant shown under high power in Figure 3.

morphonuclear leukocytes 71 per cent, lymphocytes 27 per cent, monocytes 2 per cent). Although it was now believed that the patient had acute appendicitis and operation was advised, permission for surgical interference was not granted. When distention of the abdomen coupled with a rise in white corpuscle count from 9,000 to 13,000 appeared on the following morning, permission for operation was granted.

*Operative findings:* A mass was felt in the lumen of the cecum. At the point usually occupied by the base of the appendix, there was a 2 cm. area of edematous tissue which appeared to represent the base of the appendix. Although the mass was found to be a grossly gangrenous appendix lying within the cecum, there was no external dimpling to indicate the serosal tract of the inverted appendix. (Fig. 1.)

*Operative procedure:* The abdomen was entered through a McBurney incision. The cecum was incised on the anteromedial surface from the base of the appendix upward. This exposed the interior of the cecum and permitted delivery of the gangrenous appendix. The base of the appendix, through normal cecal tissue, was excised and the incision was closed with a continuous No. 00 chromic suture. The serosa was closed with interrupted silk mattress sutures. The abdomen was closed without drainage. The pelvis was not examined since a pathologic condition sufficient to account for the symptoms had been found and there was no gross evidence of endometriosis at the time of operation.

*Postoperative course:* The patient made a good recovery except for three days of recurrent attacks of dyspnea and left the hospital twelve days after operation.

*Pathologic findings:* Grossly, the specimen consisted of an inverted appendix 6 cm. in length and 2 cm. in diameter. There was a central lumen at one end into which was pulled the fatty mesentery of the mesoappendix. The lining of this lumen was smooth and shiny. The lumen measured 3 cm. in length; the remaining 3 cm. had no lumen. The external covering of the appendix was composed of intestinal mucosa. On section there was muscle wall beneath the mucosal surface and a central core of fat.

*Microscopically*, the mucosa of the appendix was extensively ulcerated and there was recent hemorrhage into mucosa and the underlying structures. The wall of the appendix was edematous and diffusely infiltrated with polymorphonuclear leukocytes. Scattered throughout the muscle layers as well as beneath the serosa, there were large islands of endometrial tissue, including both glands and stroma. The endometrial glands appeared to be in the secretory phase. A similar island was seen in a section of subserosal fat. (Figs. 2 and 3.)

## COMMENTS

Intussusception of the appendix has been more of a surgical curiosity than a discrete or recognizable entity, since McKidd[1] reported the first case in 1859. Beyond this, however, the

FIG. 3. High power of "A" in Figure 2 showing endometrial implant in gangrene of appendix with intussusception.

etiology of the condition has been the point of principal interest. Kenneth Fraser[2] reported eighty-two cases and believed that the key to etiology was the presence of a foreign body or bolus of some type. He believes that such a bolus at the base of the appendix is gripped or entrapped by the mucosa and that appendicular peristalsis, in its effort to eject the bolus into the cecum, brings about inversion. Fraser[2] has suggested the following list of objects which may supply the obstructing bolus initiating intussusception: (1) concretion; (2) localized area of lymphoid hyperplasia; (3) nodule of scar tissue resulting from previous inflammation; (4) worms; (5) the appendiculocecal sphincter itself; (6) adenomatous polyp; (7) mucocele of the appendix. An addition to this list of etiologic factors was made in 1945 when Ingersoll and Meigs[3] reported their case of appendiceal intussusception in which there was an ectopic endometrial implant at the tip of the appendix. Although the diagnosis in their case appears firmly based in the gross findings, the appendix was unfortunately lost before histologic sections could be made. These writers also made the point that theirs was only the third case of simple appendiceal intussusception into itself. They stated that all other cases reported were of the compound variety where, in addition to intussusception of the appendix into itself, there had also been invagination of the cecum into the ascending colon.

Although preoperative diagnosis of intussusception of the appendix is unlikely except perhaps occasionally with the aid of a fortuitous barium enema x-ray, the condition merits attention because of the sometimes puzzling findings at operation. Unless the true nature of the mass in the cecal wall and lumen is suspected, it may be mistaken for a tumor, resulting, as has happened in the past as reported by Ward-McQuaid,[4] in the decision to perform right colectomy.

SUMMARY

The writers present a case of primary intussusception of the appendix, gangrenous appendicitis and endometrial implants within the appendix wall. References to the literature and a brief consideration of etiology are given.

REFERENCES

1. McKIDD, J. Case of invagination of caecum and appendix. *Edinburgh M. J.*, 4: 793, 1859.
2. FRASER, K. Intussusception of the appendix. *Brit. J. Surg.*, 31: 23–33, 1943.
3. INGERSOLL, F. M., MEIGS, J. V. Intussusception of the vermiform appendix; report of a case. *Arch. Surg.* 51: 172–173, 1945.
4. WARD-McQUAID, J. N. Case of compound intussusception of mucocele of appendix. *Brit. J. Surg.*, 37: 109–110, 1949.

# FIBROMA OF THE OVARY WITH ABDOMINAL IMPLANTS

RUSSELL O. LYDAY, M.D.
*Greensboro, North Carolina*

IN the experience of gynecologists and general surgeons fibromatous tumors of the ovary are by no means rare yet relatively few cases are found reported in the literature during the past twelve years. Furthermore, most of those cases reported during recent years were accompanied with ascites and hydrothorax, commonly called Meigs' syndrome.

Interest in this syndrome was aroused when Meigs and Cass reported a series of four cases of ovarian fibromas with this complication in 1937. The ascites and hydrothorax disappeared after removal of the tumors. From the records of the Mayo Clinic, Dockery reported 312 fibromatous tumors of the ovary that were surgically removed during the period from 1907 to 1942, an incidence of 5 per cent of all ovarian tumors removed. In 10 per cent of the cases these fibromas involved both ovaries. Fifty-one or 36 per cent of those patients had associated ascites but ascites was never present in tumors less than 6 cm. in diameter. Only two of his cases were complicated by hydrothorax. None apparently showed metastases or peritoneal implants.

In this review of the literature a similar case to the one reported here was one found by Novak who reported the first fifty cases of the Ovarian Tumor Registry. In this report he cited the case of a seventy-eight year old woman with bloody fluid in the abdomen and a large seminecrotic, semicystic tumor of the ovary with metastases to the peritoneum.

Novak stated that one pathologist diagnosed the tumor as a malignant thecoma, one sarcoma, one fibroma and another pathologist called it a dysgerminoma. A fifth pathologist called it a neurinoma, later deciding it was a glioma of teratomatous origin. The outcome of this case was not recorded.

From the varied opinions of the five pathologists in this case cited by Novak one must conclude, as he did, that there probably would be no unanimity of opinion concerning the origin or pathology of many of these ovarian tumors.

In a series of twenty-two cases reported by Marshall and Rogers there were two cases proven by operation to be complicated by ascites and hydrothorax but they made no mention of metastases or peritoneal implants. They found married women afflicted four times as frequently as unmarried women.

## CASE REPORT

The case reported here is that of a married woman of twenty-four with two children. Her menstrual history was normal except for a slight irregularity, a delay of four to eight days, for the past two months and moderate pain preceding her periods. For the past year she had complained of a poor appetite, weight loss and discomfort over the sacral region, lower abdomen, bladder region and rectum.

Because of fixation of the uterus, with a large, hard, smooth, tumor mass almost the size of a grapefruit in the left pelvis and lower abdomen, a preoperative diagnosis of malignancy was made. A moderate secondary anemia, with a hemoglobin of 65 per cent, was present. The physical examination showed nothing to suggest hydrothorax but, unfortunately, an x-ray film was not obtained until two months following the operation. It was then found negative.

*Operative Findings.* At operation, which was performed on March 20, 1948, a small amount of clear fluid was noted upon opening the abdominal cavity. A large, lobulated, hard tumor was found arising from the left ovary, filling the pelvis and adherent posteriorly to the pelvic peritoneum. The omentum was also attached to the tumor. A similar tumor the size of a walnut was situated high in the omentum and there were numerous hard, smooth nodules, ranging in size from bird shot to that of buck shot throughout the omentum. Scattered over the pelvic peritoneum were numerous similar small nodules. These were all excised. Except for a small, simple cyst in the right ovary it was normal as was the uterus. A panhysterectomy was performed.

*Pathologic Findings.* Dr. H. C. Lennon rendered the following pathologic report: Gross examination revealed nothing of significance in

the uterus and fallopian tubes but some very small cysts were present in one ovary. With the aforementioned specimens there was a large, nodular, tumor mass measuring 10 by 10 by 9.5 cm. This was quite firm and on section there was a homogenous picture throughout. The cut surface was thick and slightly yellow in color. The origin of the growth was not recognized from the gross specimen. It appeared to be fairly well encapsulated.

Microscopic sections of the ovarian tumor presented a fairly typical histologic picture of a benign fibroma. Study of the numerous sections failed to reveal any cells which could be interpreted as malignant tumor cells. Similar tumors and nodules found and examined were still fibrous in nature and showed considerable hyalinization. Pathologic diagnosis was fibromatous tumor of the ovary and abdominal implants which were all histologically benign.

Except for rather severe menopausal symptoms, which were temporary and controlled with estrogen, the patient has remained well for a period of more than three years. History and physical examination made on July 3, 1951 were entirely negative.

## COMMENT

What appears to be an unusual case of fibroma of the ovary with abdominal implants, all of which were histologically benign, is reported. In a review of the literature from 1938 to 1950, inclusively, only one case was found that presented similar characteristics but the outcome of that case was not recorded.

## REFERENCES

1. Meigs, J. V. and Cass, J. W. Fibroma of the ovary with ascites. *Am. J. Obst. & Gynec.*, 33: 249, 1937.
2. Dockery, M. B. and Masson, J. C. Clinical and pathological study of 283 patients with fibromatous tumors of the ovary. *Am. J. Obst. & Gynec.*, 47: 741, 1944.
3. Novak, E. Report of first 50 cases of Ovarian Tumor Registry conducted by American Gynecologic Society. *Am. J. Obst. & Gynec.*, 48: 861, 1944.
4. Marshall, S. F. and Rogers, L., Jr. Fibroma of the ovary: review of 22 cases at the Lahey Clinic, 1927–1945. *Surg. Clin. North America*, 25: 490, 1945.

# AUTHOR INDEX TO VOLUME LXXXIV


Abeshouse, B. S., 383
Adriani, J., 11
Aitken, A. P., 26, 261
Annan, C. M., 641
Ansbro, F. P., 3

Bacon, H. E., 596
Baggot, M. G., 363
Bailey, C. P., 335
Barnett, L. A., 107
Bates, W., 457
Beardsley, J. M., 236
Beaudet, H. A., 663
Behrend, A., 499
Bell, J. W., 378
Berman, H., 239
Bernstine, M. L., 323
Bilton, J. L., 636
Birnbaum, W., 551
Black, J. J., 3
Bloch, E., 373
Bohlman, H. R., 268
Brav, E. A., 16
Burdette, W. J., 720
Burnett, W. E., 42
Burr, H. B., 545
Burstein, C. L., 13
Butterfield, W. L., 82

Carreau, E. P., 205
Carroll, J. H., 249
Carter, H. G., 514
Caswell, H. T., 42
Caylor, H. D., 352
Chambers, W. R., 443
Chesky, V. E., 721
Cloward, R. B., 151
Cohen, E. F., 617
Cohn, I., Jr., 293
Cole, F., 326
Coley, B. L., 259
Craig, P. E., 286
Craighead, C. C., 47

Davidson, C. L., 233
Davis, C., 551
DeWeerd, J. H., 397
Dixon, C. F., 114
Dockerty, M. B., 397
Douglas, D. W., 678
Dreese, W. C., 721
Dutlinger, R. P., 368

Eidinoff, H., 592
Entine, J. H., 182
Ervin, J. R., 30

Fetchko, A. M., 249
Fisher, E. R., 328
Fletcher, J. D., 124
Fluke, S. B., 368
Forte, F. S., 620
Fraser, C. G., 717
Freund, S. J., 603
Frobese, A. S., 293
Fuzy, P. J., 524

Gaspar, M. R., 306
Geist, D. C., 118
Giles, R. C., 473
Goldfarb, W. S., 256
Goodfriend, M. J., 256
Gordon, C. A., 218, 459, 696
Gorrell, R., 72
Granet, E., 534
Graves, R. C., 279
Grossman, E., 317

Haas, A. C., 510
Hager, C. A., 238
Harberg, S., 499
Haskell, B. F., 541
Hawthorne, H. R., 293, 663
Hayes, H. T., 545
Hellwig, C. A., 721
Higgins, G. A., 205
Hilsabeck, J. R., 114, 670
Hinds, E. A., 1
Hirshfeld, J. W., 126
Hofbauer, J., 394
Hoffman, E., 693
Hofmeister, F. J., 566
Hogan, C. W., 87
Howard, M. A., 408

Ingram, I. N., 30

Jackson, A. S., 125, 625
Jaques, A. A., 507
Jefferson, N. C., 429
Jeffress, V. H., 16
Jelsma, F., 657
Johnson, E. K., 245, 476
Jonas, K. C., 77
Jorgensen, M. B., 331
Judd, E. S., Jr., 670
Judovich, B., 457, 646

Kallet, H. I., 574
Kazdan, P., 636
Kazmann, H. A., 107
Kimmel, D. L., 518
Kirksey, O. T., 486
Kleitsch, W. P., 678
Klingensmith, W., 453
Krieger, J. S., 328
Kron, S. D., 91

Lane, L. L., 335
Latteri, F. S., 3
Lattuada, H. P., 212
Leming, B. L., 202
Lester, C. W., 432
Lovell, E. S., 375
Lowbeer, L., 286
Lyday, R. O., 737

Macmanus, J. E., 61
MacMurray, F. G., 483
Mainella, F. S., 239
Mangiardi, J. L., 245, 476
Marchisello, P. J., 708
Markin, L., 317
Marrangoni, A. G., 111, 192
Marshall, W., 675
Marxen, N. L., 358
Mason, R. H., 496
Massey, F. C., 335
Mazzola, N. J., 439
Mazzola, V. P., 439
McAleese, G. B., 712
McAleese, J. J., 712
McCrea, L. E., 518
McIntyre, J. M., 610
McMillan, W. M., 496
Metzner, W. R. T., 641
Miller, D. S., 317
Miller, J. M., 356
Miller, W. C., 373
Miyakawa, G., 341
Moore, M., Jr., 449
Morton, P. C., 734
Mufson, S., 54

Necheles, H., 429
Nemir, P., Jr., 663
Neuda, P. M., 627
Noble, T. B., 419
Nunn, L. L., 252

Oakman, C. S., 734
Oktavec, W. A., Jr., 356
O'Leary, J. L., 218, 459, 696

Olson, K. C., 202
Olson, W. H., 469

Palumbo, L. T., 172
Parmley, J., 11
Parsons, L., 378
Patton, G. D., 215
Paul, R. E., 172
Pearce, A. E., 182
Pearlman, S. J., 302
Perrone, F. P., 712
Pico, L., 439
Pope, C. E., 579
Popper, H. L., 429
Prigot, A., 708

Quick, A. J., 614

Rabinovitch, J., 415
Rack, F. J., 527
Rector, R. R., 356
Richards, M. R., 328
Rigdon, R. H., 486
Robinson, J. R., 690
Rochberg, S., 693
Rosemond, G. P., 42
Rosenthal, A. H., 218, 459, 696
Ross, D. E., 313, 728
Ross, P., 657
Rumball, J. M., 131

Sanford, M. C., 483
Satinsky, V. P., 91
Saypol, G. M., 229
Scarborough, R. A., 503
Schaffer, R. C., 477
Schmitz, H. E., 558
Schottenfeld, L. E., 141
Segal, L., 684
Shute, E., 187
Shute, W., 187
Shutkin, N. M., 162
Sinaiko, E., 469
Slattery, L. R., 229
Smith, H. A., 524
Smith, R. S., 492
Snyder, E. N., Jr., 306
Spann, J. L., 286
Stalker, L. K., 195
Storer, J., 636
Summers, J. E., 177
Sutton, H. B., 126

Tankin, L. H., 383
Thiessen, N. W., 358
Towne, J. E., 558
Trace, H. D., 473
Traina, V., 13
Trimpi, H. D., 596
Trinidad, S., 415
Tyrone, C., 95

Vates, C. W., 111
Vaughn, A. M., 641

Wagner, L. C., 82
Wallace F. T., 436
Weber, J. E., 249
Weiss, E. D., 541
Westly, G. T., 172
White, B. H., 356
Whiting, J. A., 436
Wilkes, J. B., 121
Wilson, R. S., 436
Winship, T., 483
Woolner, L. B., 670
Wright, L. T., 708

Yatsuhashi, M., 378

Zinsser, H. H., 663

# SUBJECT INDEX TO VOLUME LXXIV

(E.) = Editorial; (BoB.) = Bookshelf Browsing


Abdomen
  incision of, 177
    with steel sutures, 690
Abortion, 218
Abruptio placentae, 459
Abscess of bone, 26
ACTH, effects on refrigerated homografts, 192
Adrenal cortex tumors, 239
5-Aminoacridine in appendiceal peritonitis, 663
Anastomosis
  about terminal ileum, 473
  intestinal, 469
Anesthesia
  effect of, on eosinophilic response, 13
  intravenous, in obstetric and gynecologic surgery, 439
  method of, in minor surgery, 323
  oil-soluble caudal, for anorectal surgery, 592
  spinal, for spinal surgery, 326
    postoperative, in peripheral vascular injury, 3
  transtracheal, and complications, 11
Aneurysm, mycotic, of abdominal aorta, 486
Anorectum
  changes of, during pregnancy, 579
  multiple lesions of, 534
Anus, lesions of, 551
Aorta, abdominal, aneurysm of, 486
Aortotomy for embolus, 358
Appendectomy incision, 717
Appendicitis
  and paralytic ileus, 419
  chronic, or painful ovary, 215
  recurrent, in pregnancy, 331
Appendix, primary intussusception of, 734
Artery, coronary, transection of, during commissurotomy, 335
Aureomycin packing in surgery for infections, 708

Balloon catheter after pelvic surgery, 378
Bile duct
  carcinoma of, 408
  common, detection of stones in, 229
    thoracicoabdominal approach to, 91
Biopsy, needle, of liver, 131
Bladder
  in gynecologic surgery, 279
  management after proctosigmoidectomy, 518
Blood
  loss in hemorrhoidectomies, 524
  supply, arterial, interruption of, to liver, 429
Bolen
  blood test for cancer, 641
  test for cancer, 356
Bone abscess and Salmonella B., 26
Bowel
  small, benign ulcer of, 47
  terminal, injuries to, 558
    polyps of, 510
Breast, cancer of, 313

Calculi
  renal and ureteral, removal of, 302
  staghorn, removal of, 302
Cancer
  Bolen blood test for, 641
    test for, 356
Carcinoma of breast, 313
  and fistula-in-ano, 610
  of gallbladder and bile ducts, 408
  primary, of liver, 499
  simulation of, and gastritis, 111
Cardiac arrest during surgery, 141
Carotid sinus reflex, 693
Cat scratch disease and sarcoma of neck, 483
Cecostomy, 236
Cecum, perforation of, 527
Cesarean section, postmortem, 212
Chest pain, post-thoracotomy, control of, 476
Children
  hourglass tumors of spine in, 443
  ischemic fibrosis of lower extremity in, 317
Choledochography, intra-abdominal, 229
Cirrhosis, abdominal drainage in, 233
Clubfeet, congenital, surgery for, 82
Colitis, chronic ulcerative, and pregnancy, 574
Colles' fracture, management of, 375
Colon
  as replacement of stomach in gastrectomy, 712
  explosion in during electrodesiccation of polyps, 514
  lesions of, 551
  rectosigmoid, hemangioma of, 507
  surgery of, denuded surfaces in, 596
Colostomy protector, 126
Commissurotomy and transection of coronary artery, 335
Cortisone, effects on refrigerated homografts, 192
Cryptococcosis of abdominal aorta, 486
Cystosarcoma phyllodes, 728
Cysts
  mesothelial, of peritoneum, 328
  urachal, 252

Disc
herniated cervical, 646
lumbar, 657
intervertebral, degenerated, 162
rupture of, 261
ruptured, and changes in vertebra, 151
Disease
cat scratch, 483
Hashimoto's, 286
Drain, tube bundle, 238
Drainage, abdominal, in cirrhosis, 233
Duodenum
obstruction of, 496
rupture of, in abdominal trauma, 293

Electrodesiccation
of polyps, 514
versus electrocoagulation, 510
Elbow, osteochondritis dissecans of, 121
Embolectomy, aortic, 358
Enterocolitis, pseudomembranous, acute postoperative, 114
Eosinophilic
infiltration and gastric granuloma, 107
response, effect of anesthesia on, 13
Esophagus
resections of, 61
surgery of, 306
Explosions, operating room (E.), 129

Femoral shaft, fractures of, 16
Femur, trochanteric fractures of, 449
Fibroma of ovary with abdominal implants, 737
Fibrosis, ischemic, of lower extremity in children, 317
Fistula-in-ano and carcinoma, 610
Fistulas, rectovaginal, occurring at parturition, 566
Forceps, surgical, dissecting, 124
Fracture
Colles', management of, 375
of femoral shaft, 16
review of, 341
trochanteric femoral, 449

Gallbladder
carcinoma of, 408
congenital absence of, 352
neurogenic sarcoma of, 415
Gastrectomy
partial, for duodenal ulcer, 172
replacement of stomach in, 712
total, for gastritis simulating carcinoma, 111
Gastritis, diffuse, total gastrectomy for, 111
Granuloma, gastric, with eosinophilic infiltration, 107
Gynecologic
practice in late nineteenth century (BoB.), 95
surgery, anesthesia in, 439
bladder and ureter in, 279

Hallucinations, olfactory, in schizophrenia, 620
Hashimoto's disease, 286
Hemangioma, cavernous, of rectum and rectosigmoid colon, 507
Hemorrhage in peptic ulcer, 42
Hemorrhoidectomies, blood loss in, 524
Hemostasis, defective, in surgery, 614
Hernia
diaphragmatic, and evisceration of liver, 368
subcostosternal, 245
repair of, with tantalum mesh, 54
Hip, reconstruction of, 268
Histoplasmosis, anorectal manifestations of, 541
Homografts, refrigerated, ACTH and cortisone in, 192
Hospital costs (E.), 381

Ileostomy and ileostomy bag, 77
Ileum, terminal, anastomoses about, 473
Ileus, paralytic, from peritonitis after appendicitis, 419
Incisions
abdominal, 177
with steel sutures, 690
appendectomy, 717
Infections, aureomycin packing in surgery for, 708
Injuries
occurring at parturition, perineal repair of, 566
peripheral vascular, and continuous spinal anesthesia, 3
to bowel due to pelvic malignancy and its treatment, 558
to cervical spine, 453
Intestine, anastomosis of, 469
Intussusception, primary, of appendix with endometrial implants, 734

Jejunum, leiomyosarcoma of, 492

Kidney, removal of calculi from, 302
Knee, suture of extensor mechanism of, 87

Leiomyosarcoma of jejunum, 492
Lesions
anorectal, plastic operation for, 534
neoplastic, resection of, 61
of colon, rectum and anus, industrial compensation in, 551
Liver
carcinoma of, 499
evisceration of, and diaphragmatic hernia, 368
interruption of blood supply to, 429
needle biopsy of, 131
Lymphomas, benign, of rectum, 545

Malignancy, pelvic, and bowel injuries, 558
Medicine, opportunities in (E)., 1
Mesentery, venous thrombosis of, 636

Mesocolon, transverse, pseudocyst in, 496
Mucocele, appendiceal, causes of, 670
Myxedema, fetal thyroid transplantation in, 720
Myxoma, intracanalicular, 728

Nailing, intramedullary, for femoral fracture, 16
Neck
  sarcoma of, and cat scratch disease, 483
  tumors and pseudotumors of, 72
Needle biopsy of liver, 131

Obstetric Clinics
  Abortion, 218
  Abruptio placentae, 459
  Pelvic tumors, 696
Obstruction of duodenum at ligament of Treitz, 496
Operation, plastic, for anorectal lesions, 534
Osteochondritis dissecans of elbow, 121
Ovary
  fibroma of, with abdominal implants, 737
  painful, or chronic appendicitis, 215

Pain
  and morbidity, reduction of, with thalamyd, 684
  trigger points in, 457
Pelvirectum, changes of, during pregnancy, 579
Pelvis
  phantom tumors of, 256
  tumors of, 696
Perforation
  chronic, in intractable peptic ulcer hemorrhage, 42
  obstructive, of cecum, 527
Perineal repair of rectovaginal fistulas and injuries, 566
Peritoneum, mesothelial cysts of, 328
Peritonitis
  appendiceal, 5-aminoacridine in, 663
  paralytic ileus from, 419
Pneumoperitoneum, tension, and tension pneumomediastinum, 363
Polyposis, colonic, familial, 477
Polyps
  adenomatous, of terminal bowel, 510
  electrodesiccation of, 514
Pregnancy
  and appendicitis, 331
  and chronic ulcerative colitis, 574
  and trichinosis, 249
  anorectal complications of, 579
  toxemia of, 394
Presidential address (E.), 503
Procaine pack and chest pain, 476
Proctosigmoidectomy, abdominoperineal, 518
Prosthesis, abdominal wall, tantalum mesh in, 182
Pseudocyst in mesocolon and obstruction of duodenum, 496
Pseudotumors of neck, 72
Pulmonary resection and thoracoplasty, 432

Reconstruction, replacement, of hip, 268
Rectum
  carcinoid tumor of, 603, 617
  cavernous hemangioma of, 507
  lesions of, 551
  lymphomas of, 545
  surgery of, 596
Resection
  esophageal, 61
  of neoplastic lesions, 61
  pulmonary, and thoracoplasty, 432
Retroperitoneal tumors, 397
Rupture
  of intervertebral disc in industry, 261
  retroperitoneal, of duodenum, 293

Sarcoma
  neurogenic, of gallbladder, 415
  of neck and cat scratch disease, 483
Schizophrenia, olfactory hallucinations in, 620
Screen, operating table, 125
Spine
  anesthesia in surgery of, 326
  cervical, injuries to, 453
  hourglass tumors of, 443
Stomach, replacement of, by right colon in gastrectomy, 712
Struma lymphomatosa, 286
Surgery
  anorectal, and thalamyd, 684
    anesthesia for, 592
  cardiac arrest during, 141
  defective hemostasis in, 614
  extensive, of colon and rectum, 596
  for congenital clubfeet, 82
  gynecologic, bladder and ureter in, 279
  minor, anesthesia in, 323
  obstetric and gynecologic, anesthesia in, 439
  of esophagus through right chest, 306
  pelvic, and wet colostomy, 378
  spinal, anesthesia in, 326
  tube bundle drain in, 238
Suture
  of extensor mechanism of knee, 87
  steel, in abdominal incision, 690
Sympathectomy, lumbar, in peripheral vascular disease, 202
Syndrome of degenerated intervertebral disc, 162

Tantalum
  mesh for abdominal wall prosthesis, 182
    in hernias, 54
  wire mesh in repair of hernia, 368
Test, Bolen, for cancer, 356
Thalamyd, anorectal surgery and, 684
Thoracoplasty and pulmonary resection, 432
Thromboembolism, postoperative, diagnosis of, 627

Thrombosis
peripheral, and vitamin E, 187
venous mesenteric, 636
Thyroid, fetal, transplantation of, in myxedema, 720
Toxemia of pregnancy, 394
Traction
manipulation for injuries to cervical spine, 453
suspension for femoral fracture, 16
therapy in herniated cervical disc, 646
Transection of coronary artery during mitral valvular commissurotomy, 335
Transfusion, arterial, 436
Transplantation of fetal thyroid in myxedema, 720
Trauma
abdominal, and rupture of duodenum, 293
surgical, anesthesia and eosinophilic response to, 13
Travel, value of (E.), 625
Treatment
of soft part tumors (E.), 259
of trochanteric femoral fractures, 449
Trichinosis and pregnancy, 249
Trigger points in pain, 457
Tumors
adrenal cortex, 239
and pseudotumors of neck, 72
carcinoid, of rectum, 603, 617
hourglass, of spine, 443
pelvic, 696
phantom, 256
retroperitoneal, 397
soft part, treatment of (E.), 259
uterine mixed, 721

Ulcer
benign, of small bowel, 47
duodenal, gastrectomy for, 172
gastroduodenal, acute perforated, 30
peptic, chronic perforation and hemorrhage in, 42
Urachal cysts, 252
Urachus
diseases of, 205
patent, 118
Ureter
in gynecologic surgery, 279
removal of calculi from, 302
retrocaval, 383
Uterus, mixed tumor of, 721

Varicose veins, management of, 195
Vascular disease, lumbar sympathectomy in, 202
Vas deferens, anomaly of, 373
Veins, varicose, management of, 195
Vertebra, changes in, caused by ruptured discs, 151
Vesical innervation and bladder management after proctosigmoidectomy, 518
Vitamin E in peripheral thrombosis, 187

Wet colostomy after radical pelvic surgery, 378
Wound
disruption, postoperative, 678
healing, cutaneous, 675

# The American Journal of Surgery

*Editor* THURSTON SCOTT WELTON, M.D., NEW YORK

ASSOCIATE EDITORS

BRADLEY L. COLEY, M.D., *New York;* ARNOLD S. JACKSON, M.D., *Madison;* E. ERIC LARSON, M.D., *Los Angeles*

ADVISORY BOARD

CLAUDE S. BECK, M.D., *Cleveland;* CLARENCE J. BERNE, M.D., *Los Angeles;* GEORGE R. BRIGHTON, M.D., *N. Y.;* MEREDITH F. CAMPBELL, M.D., *N. Y.;* JAMES T. CASE, M.D., *Santa Barbara;* R. LEE CLARK, JR., M.D., *Houston;* ISIDORE COHN, M.D., *New Orleans;* FREDERICK A. COLLER, M.D., *Ann Arbor;* PAUL C. COLONNA, M.D., *Philadelphia;* GORDON S. FAHRNI, M.D., *Vancouver;* HERBERT C. FETT, M.D., *Brooklyn;* EMIL GOETSCH, M.D., *Brooklyn;* CHARLES A. GORDON, M.D., *Brooklyn;* DONALD GUTHRIE, M.D., *Sayre, Pa.;* LOUIS J. HIRSCHMAN, M.D., *Detroit;* EMILE F. HOLMAN, M.D., *San Francisco;* CLAUDE J. HUNT, M.D., *Kansas City, Mo.;* T. J. KIRWIN, M.D., *N. Y.;* ARTHUR KRIDA, M.D., *N. Y.;* WALTER G. MADDOCK, M.D., *Chicago;* URBAN MAES, M.D., *New Orleans;* HARRISON S. MARTLAND, M.D., *Newark, N. J.;* RUDOLPH MATAS, M.D., *New Orleans;* CARL A. MOYER, M.D., *St. Louis;* D. W. GORDON MURRAY, M.D., *Toronto;* H. C. NAFFZIGER, M.D., *San Francisco;* EMIL NOVAK, M.D., *Baltimore;* CLARENCE R. O'CROWLEY, M.D., *Newark, N. J.;* LOUIS E. PHANEUF, M. D., *Boston;* JAMES T. PRIESTLEY, M.D., *Rochester, Minn.;* HUBERT A. ROYSTER, M.D., *Raleigh;* HENRY S. RUTH, M.D., *Philadelphia;* ROBERT L. SANDERS, M.D., *Memphis;* GRANT E. WARD, M.D., *Baltimore;* J. H. WOOLSEY, M.D., *Woodland, Calif.*

VOLUME LXXXIV

JULY TO DECEMBER

1952

THE AMERICAN JOURNAL OF SURGERY, INC.

49 WEST 45TH STREET, NEW YORK 36, N. Y.

MCMLII

COPYRIGHT, 1952
BY THE AMERICAN JOURNAL OF SURGERY, INC.
*All Rights Reserved*

*Printed in the United States of America*

# CONTENTS OF VOLUME LXXXIV

## ORIGINAL ARTICLES


| | | |
|---|---|---|
| Medicine's Opportunity of a Lifetime | *Ervin A. Hinds* | 1 |
| Postoperative Treatment of Peripheral Vascular Injury by Employment of Continuous Spinal Anesthesia Prolonged for Eleven Days | *F. Paul Ansbro*, *John J. Black*, *Francis S. Latteri* | 3 |
| Complications Following Transtracheal Anesthesia | *John Adriani*, *John Parmley* | 11 |
| Effect of Anesthesia on the Eosinopenic Response to Surgical Trauma. A Preliminary Report | *Vincenzo Traina*, *C. L. Burstein* | 13 |
| Fractures of the Femoral Shaft. A Clinical Comparison of Treatment by Traction Suspension and Intramedullary Nailing | *Col. Ernest A. Brav*, *Col. Vinnie H. Jeffress* | 16 |
| Bone Abscess Due to Salmonella B. (Bredeney) | *Alexander P. Aitken* | 26 |
| Acute Perforated Gastroduodenal Ulcer | *Ivan N. Ingram*, *John R. Ervin* | 30 |
| Role of Chronic Perforation in Intractable Massive Peptic Ulcer Hemorrhage | *H. Taylor Caswell*, *W. Emory Burnett*, *George P. Rosemond* | 42 |
| Benign Ulcer of the Small Bowel | *Claude C. Craigbead* | 47 |
| Use of Tantalum Mesh in the Repair of Hernias | *Samuel Mufson* | 54 |
| Esophageal Resections. Advantages and Management of the Combined One-stage Left Abdominal and Right Thoracic Approach for Resection of Neoplastic Lesions | *Joseph E. Macmanus* | 61 |
| Tumors and Pseudotumors in the Neck | *Ralph Gorrell* | 72 |
| Ileostomy—Evolution and Clinical Management. With a Description of a New Ileostomy Bag | *Karl C. Jonas* | 77 |
| Surgical Release of Contracted Tissues for Resistant Congenital Clubfeet | *Lewis Clark Wagner*, *Walter L. Butterfield* | 82 |
| Technic for the Suture of the Extensor Mechanism of the Knee | *Clifford W. Hogan* | 87 |
| Thoracicoabdominal Approach to the Common Bile Duct | *Victor P. Satinsky*, *Samuel D. Kron* | 91 |
| Certain Aspects of Gynecologic Practice in the Late Nineteenth Century | *Curtis Tyrone* | 95 |
| Gastric Granuloma with Eosinophilic Infiltration | *Lester A. Barnett*, *Harold A. Kazmann* | 107 |
| Total Gastrectomy for Chronic Diffuse Gastritis Simulating Carcinoma | *Albert G. Marrangoni*, *Charles W. Vates* | 111 |
| Treatment of Acute Postoperative Pseudomembranous Enterocolitis | *John R. Hilsabeck*, *Claude F. Dixon* | 114 |
| Patent Urachus | *Donald C. Geist* | 118 |
| Osteochondritis Dissecans of the Elbow | *John B. Wilkes* | 121 |
| New Surgical Dissecting Forceps | *John Dee Fletcher* | 124 |
| New Operating Table Screen | *Arnold S. Jackson* | 125 |
| New Colostomy Protector | *John W. Hirshfeld*, *Henry B. Sutton* | 126 |
| Mines Bureau Shows Way to Curb Operating Room Explosions | *T. S. W.* | 129 |

| | | |
|---|---|---|
| Needle Biopsy of the Liver. An Analysis of 308 Cases | *John M. Rumball* | 131 |
| Cardiac Arrest during Surgical Procedures. Review of the Literature with a Report of Six Cases | *Lewis E. Schottenfeld* | 141 |
| Changes in the Vertebra Caused by Ruptured Intervertebral Discs. Observations on Their Formation and Treatment | *Ralph B. Cloward* | 151 |
| Syndrome of the Degenerated Intervertebral Disc | *Ned M. Shutkin* | 162 |
| Evaluation of the Results of Partial Gastrectomy for the Treatment of Duodenal Ulcer | *Louis T. Palumbo*, *R. E. Paul*, *G. T. Westly* | 172 |
| Abdominal Incisions. Present Status in the United States | *John E. Summers* | 177 |
| Experimental Studies Using Tantalum Mesh As a Full-thickness Abdominal Wall Prosthesis | *A. E. Pearce*, *J. H. Entine* | 182 |
| Peripheral Thrombosis Treated with Alpha Tocopherol (Vitamin E) | *Evan Shute*, *Wilfrid Shute* | 187 |
| Effects of ACTH and Cortisone on Refrigerated Homografts in the Experimental Animal | *Albert G. Marrangoni* | 192 |
| Management of Varicose Veins and Their Related Problems | *Leonard K. Stalker* | 195 |
| Lumbar Sympathectomy in Peripheral Vascular Diseases | *Kenneth C. Olson*, *Ben L. Leming* | 202 |
| Diseases of the Urachus. With Three Illustrative Case Reports | *Ernest P. Carreau*, *George A. Higgins* | 205 |
| Postmortem Cesarean Section. Surgical and Legal Aspects | *Henry P. Lattuada* | 212 |
| Chronic Appendicitis or Painful Ovary? | *George D. Patton* | 215 |
| Abortion | *Charles A. Gordon*, *Alexander H. Rosenthal*, *James L. O'Leary* | 218 |
| Intra-abdominal Choledochography. Preliminary Report of a Method of Detecting Stones in the Common Bile Duct | *Louis R. Slattery*, *George M. Saypol* | 229 |
| Abdominal Drainage in Cirrhosis by Use of Glass Button | *Chester L. Davidson* | 233 |
| Cecostomy | *J. Murray Beardsley* | 236 |
| The Tube Bundle Surgical Drain | *Chauncey A. Hager* | 238 |
| Adrenal Cortex Tumors | *Harry Berman*, *Frank S. Mainella* | 239 |
| Subcostosternal Diaphragmatic Hernia | *E. K. Johnson*, *Joseph L. Mangiardi* | 245 |
| Trichinosis Complicating Pregnancy | *A. M. Fetchko*, *J. E. Weber*, *J. H. Carroll* | 249 |
| Urachal Cysts and Their Complications | *Leslie L. Nunn* | 252 |
| Pelvic Phantom Tumors | *Milton J. Goodfriend*, *William S. Goldfarb* | 256 |
| Treatment of Soft Part Tumors | *Bradley L. Coley* | 259 |
| Rupture of the Intervertebral Disc in Industry. Further Observations on the End Results | *Alexander P. Aitken* | 261 |

| | | |
|---|---|---|
| Replacement Reconstruction of the Hip | *Harold R. Boblman* | 268 |
| The Bladder and Ureter in Gynecology | *Roger Colgate Graves* | 279 |
| Hashimoto's Disease (Struma Lymphomatosa). A Familial Incidence of Three Cases | *Paul E. Craig*<br>*Joseph L. Spann*<br>*Leo Lowbeer* | 286 |
| Retroperitoneal Rupture of the Duodenum in Non-penetrating Abdominal Trauma | *Isidore Cohn, Jr.*<br>*Herbert R. Hawthorne*<br>*Alfred S. Frobese* | 293 |
| Surgical Considerations in Removal of Renal and Ureteral Calculi. With Special Emphasis on Removal of Staghorn Calculi | *S. Joseph Pearlman* | 302 |
| Surgery of the Esophagus through the Right Chest | *Max R. Gaspar*<br>*Edward N. Snyder, Jr.* | 306 |
| Cancer of the Breast | *Donald E. Ross* | 313 |
| Ischemic Fibrosis of the Lower Extremity in Children | *Donald S. Miller*<br>*Leo Markin*<br>*Edward Grossman* | 317 |
| A Simple Method of Anesthesia for Minor Surgical Procedures | *Melvin L. Bernstine* | 323 |
| Spinal Anesthesia for Spinal Operations | *Frank Cole* | 326 |
| Multiple Mesothelial Cysts of the Peritoneum | *James S. Krieger*<br>*Edwin R. Fisher*<br>*M. R. Richards* | 328 |
| Recurrent Appendicitis in Each Trimester of Pregnancy. With a Case Report in Each Trimester | *Melford B. Jorgensen* | 331 |
| Transection of a Coronary Artery during the Course of Mitral Valvular Commissurotomy | *Lowell L. Lane*<br>*Franklin C. Massey*<br>*Charles P. Bailey* | 335 |
| Review of 4,284 Fractures | *George Miyakawa* | 341 |
| Congenital Absence of Gallbladder | *Harold D. Caylor* | 352 |
| The Bolen Test for Cancer | *Beverly H. White*<br>*Robert R. Rector*<br>*Joseph M. Miller*<br>*William A. Oktavec Jr.* | 356 |
| Successful Direct Aortic Embolectomy | *Norman W. Thiessen*<br>*Norman L. Marxen* | 358 |
| Acute Tension Pneumoperitoneum Causing Tension Pneumomediastinum. A Preliminary Report | *M. G. Baggot* | 363 |
| Non-traumatic Diaphragmatic Hernia with Complete Evisceration of the Liver. Repair with Tantalum Wire Mesh | *Robert P. Dutlinger*<br>*Samuel B. Fluke* | 368 |
| Anomaly of the Vas Deferens | *Emile Bloch*<br>*W. C. Miller* | 373 |
| New Aid in the Management of Colles' Fracture | *E. Sherburne Lovell* | 375 |
| Problems in Wet Colostomy Management Following Radical Pelvic Surgery. Use of a New Giant Balloon Catheter | *John W. Bell*<br>*Masao Yatsubashi*<br>*Langdon Parsons* | 378 |
| Hospital Costs | *T. S. W.* | 381 |
| Retrocaval Ureter. Report of a Case and a Review of the Literature | *Benjamin S. Abesbouse*<br>*Louis H. Tankin* | 383 |

| | | |
|---|---|---|
| Progress vs. Perpetuation of Error Concerning the Origin of Pregnancy Toxemia | *J. Hofbauer* | 394 |
| Lipomatous Retroperitoneal Tumors | *James H. DeWeerd*, *Malcolm B. Dockerty* | 397 |
| Carcinoma of the Gallbladder and Bile Ducts | *Martin A. Howard* | 408 |
| Primary Neurogenic Sarcoma of the Gallbladder | *Jacob Rabinovitch*, *Salvador Trinidad* | 415 |
| Paralytic Ileus from Peritonitis after Appendicitis | *Thomas B. Noble* | 419 |
| Interruption of All Arterial Blood Supply to the Liver Not Compatible with Life. Experimental Study | *H. L. Popper*, *N. C. Jefferson*, *H. Necheles* | 429 |
| Modified Thoracoplasty Performed with Pulmonary Resection | *Charles W. Lester* | 432 |
| Arterial Transfusion | *Richard S. Wilson*, *Furman T. Wallace*, *James A. Whiting* | 436 |
| Intravenous Anesthesia in Major Obstetric and Gynecologic Surgery. Report of 1,301 Cases | *Vincent P. Mazzola*, *N. J. Mazzola*, *Lawrence Pico* | 439 |
| Hourglass Tumors of the Spine in Children. A Report of Five Cases | *William R. Chambers* | 443 |
| Treatment of Trochanteric Femoral Fractures with Special Reference to Complications | *Moore Moore, Jr.* | 449 |
| Traction-manipulation for Injuries to the Cervical Spine | *William Klingensmith* | 453 |
| So-called Trigger Points | *Bernard Judovich*, *William Bates* | 457 |
| Abruptio Placentae | *Charles A. Gordon*, *Alexander H. Rosenthal*, *James L. O'Leary* | 459 |
| Intestinal Anastomosis. A New Method and a New Instrument | *E. Sinaiko*, *Wm. H Olson* | 469 |
| Anastomoses about the Terminal Ileum | *Herbert D. Trace*, *Roscoe C. Giles* | 473 |
| Procaine Pack. Control of Post-thoracotomy Chest Pain | *E. K. Johnson*, *J. L.Mangiardi* | 476 |
| Familial Colonic Polyposis. Review of the Literature and Report of Four Cases | *Richard C. Schaffer* | 477 |
| Cat Scratch Disease Simulating Sarcoma of the Neck | *Frank G. MacMurray*, *Marshall C. Sanford*, *Theodore Winship* | 483 |
| Mycotic Aneurysm (Cryptococcosis) of the Abdominal Aorta | *R. H. Rigdon*, *O. T. Kirksey* | 486 |
| Leiomyosarcoma of the Jejunum | *Robert S. Smith* | 492 |
| Pseudocyst in the Transverse Mesocolon Producing Obstruction of the Duodenum at the Ligament of Treitz | *William M. McMillan*, *R. H. Mason* | 496 |
| Primary Carcinoma of the Liver | *Albert Behrend*, *Sidney Harberg* | 499 |
| Presidential Address | *Robert A. Scarborough* | 503 |

| | | |
|---|---|---|
| Cavernous Hemangioma of the Rectum and Rectosigmoid Colon | *Alan A. Jaques* | 507 |
| Electrodesiccation versus Electrocoagulation. Their Application to Adenomatous Polyps of the Terminal Bowel | *Albert C. Haas* | 510 |
| Explosion in the Colon during Electrodesiccation of Polyps | *H. Gray Carter* | 514 |
| A New Concept of Vesical Innervation and Its Relationship to Bladder Management Following Abdominoperineal Proctosigmoidectomy | *Lowrain E. McCrea*<br>*Donald L. Kimmel* | 518 |
| Blood Loss in Hemorrhoidectomies | *P. J. Fuzy*<br>*H. A. Smith* | 524 |
| Obstructive Perforation of the Cecum. Report of Eight Cases | *Frank J. Rack* | 527 |
| Plastic Operation for Multiple Anorectal Lesions | *Emil Granet* | 534 |
| Anorectal Manifestations of Histoplasmosis | *Edward D. Weiss*<br>*Benjamin F. Haskell* | 541 |
| Benign Lymphomas of the Rectum | *Herbert T. Hayes*<br>*Harry B. Burr* | 545 |
| Industrial Compensation Aspects of Lesions of Colon, Rectum and Anus | *Walter Birnbaum*<br>*Cooper Davis* | 551 |
| Injuries to the Terminal Bowel Due to Pelvic Malignancy and Its Treatment | *Herbert E. Schmitz*<br>*Janet E. Towne* | 558 |
| Reconstructive Perineal Repair of Rectovaginal Fistulas and Injuries Occurring at Parturition | *Fred J. Hofmeister* | 566 |
| Influence of Pregnancy on Chronic Ulcerative Colitis | *Herbert I. Kallet* | 574 |
| Anorectal Complications of Pregnancy. Anatomic and Physiologic Changes of the Anorectum and Pelvirectum during Pregnancy | *Charles Evans Pope* | 579 |
| Oil-soluble Caudal Anesthesia for Anorectal Surgery | *Harold Eidinoff* | 592 |
| Clinical and Experimental Study of Denuded Surfaces in Extensive Surgery of the Colon and Rectum | *Howard D. Trimpi*<br>*Harry E. Bacon* | 596 |
| Carcinoid Tumor of the Rectum | *Samuel J. Freund* | 603 |
| Carcinoma Associated with Fistula-in-ano | *J. M. McIntyre* | 610 |
| Problem of Defective Hemostasis in Surgery | *Armand J. Quick* | 614 |
| Carcinoid Tumors of the Rectum | *Edmond F. Cohen* | 617 |
| Olfactory Hallucinations as a Proctologic Manifestation of Early Schizophrenia | *Frank S. Forte* | 620 |
| The Value of Travel | *Arnold S. Jackson* | 625 |
| Early Diagnosis and Prevention of Postoperative Thromboembolism | *Paul M. Neuda* | 627 |
| Venous Mesenteric Thrombosis. Suggested Etiology and Case Report | *John Storer*<br>*Philip Kazdan*<br>*Joseph L. Bilton* | 636 |
| Evaluation of the Bolen Blood Pattern Test for Detecting Cancer | *Arkell M. Vaughn*<br>*Wesley R. T. Metzner*<br>*Cornelius M. Annan* | 641 |
| Herniated Cervical Disc. A New Form of Traction Therapy | *Bernard D. Judovich* | 646 |
| Postoperative Analysis of 366 Consecutive Cases of Herniated Lumbar Discs | *Paul Ross*<br>*Franklin Jelsma* | 657 |

| | | |
|---|---|---|
| Studies on 5-Aminoacridine in Experimental Appendiceal Peritonitis | *Paul Nemir, Jr.*, *H. H. Zinsser*, *H. A. Beaudet*, *H. R. Hawthorne* | 663 |
| Some Uncommon Causes of Appendiceal Mucocele | *John R. Hilsabeck*, *Lewis B. Woolner*, *Edward S. Judd, Jr.* | 670 |
| Some Pathologic Aspects of Cutaneous Wound Healing | *Wallace Marshall* | 675 |
| Postoperative Wound Disruption | *William P. Kleitsch*, *Dale W. Douglas* | 678 |
| Reduction of Pain and Morbidity in Anorectal Surgery with Thalamyd | *Louis Segal* | 684 |
| Closure of Abdominal Incision with Continuous Steel Sutures | *John R. Robinson* | 690 |
| Hypersensitive Carotid Sinus Reflex | *Elmer Hoffman*, *Samuel Rochberg* | 693 |
| Pelvic Tumors | *Charles A. Gordon*, *Alexander H. Rosenthal*, *James L. O'Leary* | 696 |
| Aureomycin Packing As an Adjunct to the Surgical Treatment of Localized Infections | *Peter J. Marchisello*, *Aaron Prigot*, *Louis T. Wright* | 708 |
| Replacement of the Stomach by the Right Colon in Total Gastrectomy | *J. J. McAleese*, *F. P. Perrone*, *G. B. McAleese* | 712 |
| A More Ideal Appendectomy Incision | *Charles G. Fraser* | 717 |
| Attempted Transplantation of Fetal Thyroid in a Case of Myxedema | *Walter J. Burdette* | 720 |
| Uterine Mixed Tumor of Nine Years' Duration | *V. E. Chesky*, *W. C. Dreese*, *C. A. Hellwig* | 721 |
| Cystosarcoma Phyllodes (Giant Intracanalicular Myxoma) | *Donald E. Ross* | 728 |
| Primary Intussusception of Appendix with Endometrial Implants | *Paul C. Morton*, *Carl S. Oakman* | 734 |
| Fibroma of the Ovary with Abdominal Implants | *Russell O. Lyday* | 737 |

....INSTEAD OF UNPHYSIOLOGICAL "PHYSIOLOGICAL SALINE"*

*Here's how new POLYSAL† /CUTTER helps your patients:*

**1. Polysal** prevents and corrects hypopotassemia without danger of toxicity.[1]

**2. Polysal** corrects moderate acidosis without inducing alkalosis.[1]

**3. Polysal** replaces the electrolytes in extracellular fluid.[1]

**4. Polysal** induces copious secretion of urine and salt.[1]

Polysal, a *single* solution to build electrolyte balance, is recommended for electrolyte and fluid replacement in all medical, surgical and pediatric patients where saline or other electrolyte solutions would ordinarily be given. Write for literature and handy wallet-size mEq chart . . . Cutter Laboratories, Berkeley, California.

1. Fox, C. L. Jr., et. al.: An Electrolyte Solution Approximating Plasma Concentrations with Increased Potassium for Routine Fluid and Electrolyte Replacement, J. A. M. A., March 8, 1952.

†*Cutter Trade Mark*

*In distilled water—*
*250 cc. and 1000 cc.*

***MAKE *New* POLYSAL YOUR ROUTINE PRESCRIPTION**

# AN *Invitation* TO MEMBERSHIP IN A MEDICAL JOURNAL FOR WHICH THERE IS A DEFINITE NEED

The
American Journal
of Medicine
Not merely another Journal BUT a practical teaching Journal on Post-Graduate Medicine
PRESENTING
SEMINARS • CLINICAL and THERAPEUTIC CONFERENCES
SYMPOSIA and ORIGINAL CLINICAL INVESTIGATIONS

**Editor**
Alexander B. Gutman, N.Y.C.

**Advisory Board**
David P. Barr, N.Y.C.
Arthur L. Bloomfield, San Francisco, Calif.
Eugene A. Stead, Durham, N.C.
Joseph T. Wearn, Cleveland, O.

**Associate Editors**
Herrman L. Blumgart, Boston
Harry Gold, N.Y.C.
A. McGehee Harvey, Baltimore
George H. Houck, Palo Alto
Chester S. Keefer, Boston
T. Grier Miller, Philadelphia
Walter L. Palmer, Chicago
Oswald H. Robertson, Stanford
Ephraim Shorr, N.Y.C.
George W. Thorn, Boston
William S. Tillett, N.Y.C.
Roy H. Turner, New Orleans
Russell M. Wilder, Bethesda, Md.
M. M. Wintrobe, Salt Lake City
W. Barry Wood, St. Louis
John B. Youmans, Nashville

THE YORKE PUBLISHING COMPANY, INC.
*also publishers of The American Journal of Surgery*

## SUBSCRIPTION ORDER FORM

THE AMERICAN JOURNAL OF MEDICINE
49 WEST 45TH STREET, NEW YORK 36, N.Y.

Please enter my subscription to the new monthly journal, THE AMERICAN JOURNAL OF MEDICINE. Subscription U.S.A. $12 per year. $13 Canada, $15 Foreign

NAME_____ ADDRESS_____

CITY_____ STATE_____

# COOK COUNTY
# GRADUATE SCHOOL OF MEDICINE

***Postgraduate Courses—Winter, 1952–1953***

SURGERY—Intensive Course in Surgical Technic, Two Weeks, starting January 19, February 2, February 16
Surgical Technic, Surgical Anatomy & Clinical Surgery, Four Weeks, starting March 2
Surgical Anatomy & Clinical Surgery, Two Weeks, starting March 16
Basic Principles in General Surgery, Two Weeks, starting March 23
Gallbladder Surgery, Ten Hours, starting April 20
Surgery of Colon & Rectum, One Week, starting March 2
General Surgery, One Week, starting February 9
General Surgery, Two Weeks, starting April 20
Fractures and Traumatic Surgery, Two Weeks, starting March 2

GYNECOLOGY—Intensive Course, Two Weeks, starting February 16
Vaginal Approach to Pelvic Surgery, One Week, starting March 2

OBSTETRICS—Intensive Course, Two Weeks, starting March 2

PEDIATRICS—Intensive Course, Two Weeks, starting April 6

MEDICINE—Intensive General Course, Two Weeks, starting May 4
Electrocardiography & Heart Disease, Two Weeks, starting March 16
Allergy, One Month and Six Months, by appointment

UROLOGY—Intensive Course, Two Weeks, starting April 13
Ten-Day Practical Course in Cystoscopy starting every two weeks

DERMATOLOGY—Intensive Course, Two Weeks starting May 4

**TEACHING FACULTY—ATTENDING STAFF**
**of Cook County Hospital**

**Address Registrar, 707 South Wood Street, Chicago 12, Illinois**

# THE NEW YORK POLYCLINIC
## MEDICAL SCHOOL AND HOSPITAL
**(ORGANIZED 1881)**
***(The Pioneer Post-Graduate Medical Institution in America)***

### SURGERY and ALLIED SUBJECTS

A combined surgical course comprising general surgery, traumatic surgery, abdominal surgery, gastroenterology, proctology, gynecological surgery, urological surgery. Attendance at lectures, witnessing operations, examination of patients pre-operatively and post-operatively and follow-up in the wards post-operatively. Pathology, radiology, physical medicine, anesthesia. Cadaver demonstrations in surgical anatomy, thoracic surgery, proctology, orthopedics. Operative surgery and operative gynecology on the cadaver; attendance at departmental and general conferences.

### FOR THE GENERAL PRACTITIONER

Intensive full time instruction covering those subjects which are of particular interest to the physician in general practice. Fundamentals of the various medical and surgical specialties designed as a practical review of established procedures and recent advances in medicine and surgery. Subjects related to general medicine are covered and the surgical departments participate in giving fundamental instruction in their specialties. Pathology and radiology are included. The class is expected to attend departmental and general conferences.

### RADIOLOGY

A comprehensive review of the physics and higher mathematics involved, film interpretation, all standard general roentgen diagnostic procedures, methods of application and doses of radiation therapy, both x-ray and radium, standard and special fluoroscopic procedures. A review of dermatological lesions and tumors susceptible to roentgen therapy is given, together with methods and dosage calculation of treatments. Special attention is given to the newer diagnostic methods associated with the employment of contrast media, such as bronchography with Lipiodol, uterosalpingography, visualization of cardiac chambers, peri-renal insufflation and myelography. Discussions covering roentgen departmental management are also included.

### PHYSICAL MEDICINE AND REHABILITATION

Didactic lectures and active clinical application of all present-day methods of physical medicine in internal medicine, general and traumatic surgery, gynecology, urology, dermatology, neurology and pediatrics. Special demonstrations in minor electrosurgery and electrodiagnosis. The diagnostic tests used in Physical Medicine. Technics in rehabilitation of the seriously disabled.

**FOR INFORMATION ABOUT THESE AND OTHER COURSES ADDRESS**

**THE DEAN, 345 West 50th Street, NEW YORK 19, N. Y.**

# INDISPUTABLE PROOF of an INDISPENSABLE SERVICE

## New 5TH EDITION MODERN DRUG AND THERAPEUTIC

### IN *REGULAR USE* BY 91% OF ALL DOCTOR

Dramatic proof of the finger tip reference value of THE MODERN DRUG ENCYCLOPEDIA and its bi-monthly supplementary service, MODERN DRUGS, comes direct from 3,000 of their 50,000 doctor and druggist users. Results of an independently* conducted reader-research effort show overwhelming dependence upon this quick reference service—complete from description to prescription for authoritative data on new ethical drugs. Com-

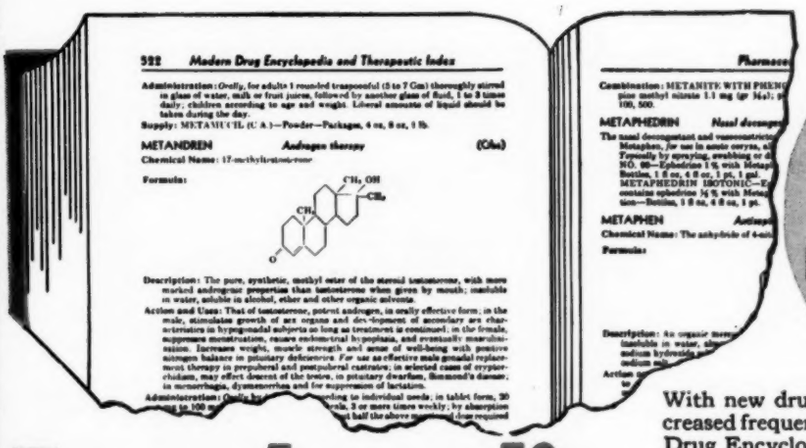
**THE MODERN DRUG ENCYCLOPEDIA**
is handsomely bound in red fabricoid. Contains 1500 pages, size 6" x 9¼" x 2¼". POSTPAID, $15** U.S.A.; $18 FOREIGN

EDITED BY
**MARION E. HOWARD,**
M.D., F.A.C.P.
Yale University
Medical School

**MODERN DRUGS SUPPLEMENTS**
are sent (beginning Jan. 1953) bi-monthly FREE to every encyclopedia subscriber. Keeps you up-to-date between editions. Complete with cumulative index for accurate reference to all new products therapeutically and alphabetically.

## DRUG PUBLICATIONS, INC.

**49 West 45th Street, New York 36, New York**


522 Modern Drug Encyclopedia and Therapeutic Index

Administration: Orally, for adults 1 rounded teaspoonful (5 to 7 Gm) thoroughly stirred in glass of water, milk or fruit juices, followed by another glass of fluid, 1 to 3 times daily; children according to age and weight. Liberal amounts of liquid should be taken during the day.

Supply: METAMUCIL (U.S.A.)—Powder—Packages, 4 oz, 8 oz, 1 lb.

METANDREN Androgen therapy (C20H30O2)

Chemical Name: 17-methyltestosterone

Formula:

Description: The pure, synthetic, methyl ester of the steroid testosterone, with more marked androgenic properties than testosterone when given by mouth; insoluble in water, soluble in alcohol, ether and other organic solvents.

Action and Uses: That of testosterone, potent androgen, in orally effective form; in the male, stimulates growth of sex organs and development of secondary sex characteristics in hypogonadal subjects so long as treatment is continued; in the female, suppresses menstruation, causes endometrial hypoplasia, and eventually masculinization. Increases weight, muscle strength and sense of well-being with positive nitrogen balance in pituitary deficiencies. For use as effective male gonadal replacement therapy in prepuberal and postpuberal castrates; in selected cases of cryptorchidism, may effect descent of the testes; in pituitary dwarfism, Hammond's disease; in menorrhagia, dysmenorrhea and for suppression of lactation.

Administration: Orally, [illegible] according to individual needs; in tablet form, 30 mg to 100 mg [illegible] daily, 3 or more times weekly; by absorption [illegible] half the above [illegible] dose required

Pharmaco

Combination: METANITE WITH PHEN[illegible] pine methyl nitrate 1.1 mg (gr 1/64); p[illegible] 100, 500

METAPHEDRIN Nasal decongest[illegible]

The nasal decongestant and vasoconstrictor Metaphen, for use in acute coryza, a[illegible] Topically by spraying, swabbing or d[illegible] NO. 00—Ephedrine 1 % with Metaph[illegible] Suction, 1 fl oz, 4 fl oz, 1 pt, 1 gal. METAPHEDRIN ISOTONIC—E[illegible] contains ephedrine 1/4 % with Metaph[illegible] tion—Suction, 1 fl oz, 4 fl oz, 1 pt.

METAPHEN Antiseptic

Chemical Name: The anhydride of 4-nitr[illegible]

Formula:

Description: An organic mercu[illegible] insoluble in water, slightly soluble in sodium hydroxide s[illegible] sodium nitr[illegible]

Action and Uses: [illegible] to

# Encyclopedia

## INDEX

## AND DRUGGIST SUBSCRIBERS

pletely rewritten, the new 5th Edition of THE MODERN DRUG ENCYCLOPEDIA lists nearly 4,000 ethical drugs (including 1,500 brand new listings) of 175 manufacturers. Each listing includes latest composition, action, use, supply, dosage, caution and contra-indication of the drug. Here is data that you, too, will find indispensable for saving time, without sacrifice of an authoritative source.

## FINGER TIP DESCRIPTIONS AUTHORITATIVELY COMPILED IN SEVEN SPECIAL SECTIONS

- Drugs
- Biologicals
- Allergens
- General Index
- Therapeutic Index
- Manufacturer's Index

***featuring for the first time***

- Self Pronouncing Drug Listings
- Generic Name Index

*AUDIENCE ANALYSTS, Phila., Pa.

## TYPICAL COMMENTS from DOCTOR USERS

With new drugs and preparations coming with increased frequency and volume, a book such as Modern Drug Encyclopedia is indispensable.

*New York, New York*

I have owned every edition of your encyclopedia except the first. Would have bought it but did not know this book was printed. If the physicians of this country and Canada and some of the foreign countries knew its value, you would have been able to sell twice as many or more books per year.

*Memphis, Tennessee*

I like Modern Drugs because it gives honest pharmacological information; because it frequently gives contra-indications and dangers; because it describes members of a similar group in similar or identical terms. I would find it hard to practice without it.

*Green Bay, Wis.*

I have Modern Drug Encyclopedia and use the journal as supplement, thus at my finger tips I have information on new drugs.

*York, Pa.*

I don't see how a physician can know what other physicians prescribe for patients without this. It is an almost indispensable (not quite) adjunct to my practice.

*Washington, D.C.*

I find the bound book (present 5th Edition) most valuable.

*White Plains, N.Y.*

One of my most valuable books and used more often than any other that I have.

*Lincolnton, N.C.*

MAIL THIS COUPON NOW!

**DRUG PUBLICATIONS, INC.**

**49 West 45th Street, New York 36, New York**

Enclosed is the sum of fifteen dollars ($15**U.S.A.) for which please send me postpaid the new Fifth Edition of THE MODERN DRUG ENCYCLOPEDIA AND THERAPEUTIC INDEX and MODERN DRUGS. (New York City residents please add 3% for sales tax.)

NAME _____ M.D.

ADDRESS _____

CITY _____ ZONE _____ STATE _____

**Includes three-year supplementary service at $3 per year.

**CONTROL AND SIMPLICITY OF OPERATION**

**--combine to make**

**THE**

*Burdick*

**McLELLAN SUCTION UNIT**

**(SA-1)**

—the equipment of choice for gentle bedside drainage.

- continuous operation without overheating
- noiseless in operation
- overflow protection
- pressure gauge
- pressure lock
- exceptionally light weight (11 pounds)

*Burdick Service for Burdick Equipment*

**THE BURDICK CORPORATION**
MILTON, WISCONSIN

**61st YEAR OF PUBLICATION**

**The Leading Independent Surgical Journal**

**PRESENTS THE PAPERS OF . . .**
**The American Association for the Surgery of Trauma**
•
**The American Proctologic Society**
•

**OTHER REGULAR FEATURES . . .**
**The Obstetric Clinic**
**Modern Operative Technics**
**Practical Surgical Suggestions**
**Streamlined Articles**

START YOUR SUBSCRIPTION WITH THIS ISSUE

The American Journal of Surgery
49 West 45th St., New York 36, N. Y.

Please enter my subscription to The American Journal of Surgery. Yearly $12.00 U.S.A.—$13.00 Canada & Pan American Countries—$15 Foreign

Name.....

Address.....

City.....Zone.....State.....

*for the successful treatment of...*

**LEG ULCERS**

**the DAXALAN-DOME-PASTE BANDAGE TECHNIQUE**

AS EMPLOYED in the Department of Peripheral Vascular Diseases—New York Polyclinic Medical School and Hospital.

DOMEBORO TABS is listed as "BUROW'S SOLUTION-DOMEBORO TABS", on Page 376, in the "Manual of Dermatology"—issued under the auspices of the National Research Council and is recommended to be used wherever Burow's Solution is indicated.

This technique is based on a 3 point program:

1. Reduce the dermatitis with wet dressings of DOMEBORO TABS (BUROW'S SOLUTION).
2. Combat local infection and stimulate healing with thick application of DAXALAN in the center of the ulcer and surrounding areas.
3. Overcome venous insufficiency, statis and edema by wrapping DOME-PASTE BANDAGE (Unna's Boot) around the entire leg to supply compression.

Dome-Paste Bandage Is Now Accepted by the A.M.A. Council on Physical Medicine and Rehabilitation

DOCTOR!
You may now prescribe
SOOTHING
Modernized — Simplified
Fresh and Stable
BUROW'S SOLUTION
1:20
in four forms
DOMEBORO
Tablets • Packets • Powder
Ointment
Write for samples and reprints from medical literature

**DOME CHEMICALS, INC.**
109 W. 64th STREET, NEW YORK 23, N. Y.
*Makers of the Soothing, Modernized Form of Burow's Solution*
DOMEBORO—Tablets • Powder • Packets • Ointment

---

# UNVARYING QUALITY

Because of the meticulous care with which Deknatel Surgical Silk is manufactured, the sutures you use today—tomorrow—next year—will be of the same uniformity of diameter, tensile strength, pliability. Further, its non-capillary, non-oxidizing, non-slipping qualities will be identical—suture after suture, yard after yard, spool after spool. This unvarying quality has built a reputation for dependability that has resulted in steadily increased use of Deknatel Silk Sutures by the surgical profession, year after year, for more than 20 years. J. A. Deknatel & Son, Queens Village 29, L. I., New York.

*Sold by Surgical-Hospital Supply Houses.*

**DEKNATEL SURGICAL SUTURES**
**The First and Still The First**

OTHER DEKNATEL PRODUCTS—DEKNATEL SURGICAL NYLON, MINIMAL-TRAUMA NEEDLES WITH ATTACHED SUTURES, NAME-ON BEADS

# Outside the Ivory Tower

THE AMERICAN UROLOGICAL ASSOCIATION offers an annual award of $1,000.00 (first prize of $500.00, second prize $300.00 and third prize $200.00) for essays on the result of some clinical or laboratory research in urology. Competition shall be limited to urologists who have been in such specific practice for not more than five years and to men in training to become urologists. The first prize essay will appear on the program of the forthcoming meeting of the American Urological Association, to be held at the Hotel Jefferson, St. Louis, Missouri, May 11–14, 1953. For full particulars write the Executive Secretary, William P. Didusch, 1120 North Charles Street, Baltimore, Maryland. Essays must be in his hands before January 15, 1953.

AN award for its vision, research and accomplishments and specifically for development of a longer lasting penicillin (Bicillin) which in antibiotic therapy will result in broadening of health vistas for the people of our country, was presented recently to Wyeth Incorporated by the Chamber of Commerce of Greater Philadelphia. Harry S. Howard, president of Wyeth Incorporated, accepted the award from Col. J. Harry LaBrum, Chamber president at the Wyeth executive offices in Philadelphia. In accepting the award for the company, Howard paid tribute to all Wyeth people for their part in making the citation possible.

THIRTY-FOUR Public Health Service grants, totaling $523,993, to aid cancer control studies and demonstrations in sixteen States, the District of Columbia, and one foreign country, Israel, were announced by the Federal Security Agency.

The grants were made by Surgeon General Leonard A. Scheele on recommendation of the National Advisory Cancer Council, a group of non-government physicians, scientists and leaders in public affairs. They will be administered by the National Cancer Institute of the National Institutes of Health. Preliminary review of grant applications was performed for the Council by the Cancer Control Committee, whose members are drawn from the American College of Surgeons, American Cancer Society, State health departments, hospitals and medical schools.

THE American Psychosomatic Society will hold its Tenth Annual Meeting at Chalfonte-Hadden Hall, in Atlantic City, on May 2 and 3, 1953. The Program Committee would like to receive titles and abstracts of papers for consideration for the program, by December 1, 1952. The time allotted for the reading of each paper will be twenty minutes. The Committee is interested in investigations in the theory and practice of psychosomatic medicine as applied to adults and children in all the medical specialties, and in contributions in psychophysiology and ecology. There will be one panel devoted to the adrenal cortex. Abstracts of contributions to this panel will be considered by the Committee. Papers accepted for presentation at the Meeting will be submitted to the Editorial Board of Psychosomatic Medicine for possible publication in the Journal.

Material for consideration by the Program Committee should be sent, in duplicate, to Dr. Sydney G. Margolin, Chairman, 551 Madison Avenue, New York 22, New York.

THE Food and Drug Administration issued an official press release explaining the basis of its decision to permit the continued distribution of Parke, Davis' Chloromycetin under revised labeling ("F-D-C Drug Letter," August 11). In this statement, Food and Drug Commissioner Crawford declared: "The Administration has weighed the value of the drug against its capabilities for causing harm and has decided that it should continue to be available for careful use by the medical profession in those serious and sometimes fatal diseases in which its use is necessary. FDA's decision was similar in principle to one made every day by thousands of doctors throughout the country who weigh the need for a potent drug against the possibility of harm to the patient."

EXCEPT for early adult life, mortality from cancer among males is higher than among females, said statisticians of the Metropolitan Life Insurance Company. A study of deaths from malignant neoplasms among the Metropolitan's Industrial policy holders during 1950 and 1951 shows that only between the ages of twenty-five to forty-four do more women than men die from cancer. In the forty-five to fifty-four age group the deaths are about equal, but at all other ages the male deaths are much higher.

*(continued on page 42)*

# The Surgeon's Mart

*When you are in need of surgical instruments or medical supplies you will find the dealers and manufacturers listed below ready to serve you. For your guidance when purchasing supplies we submit this list.*


**SPECIALISTS**

**NEEDLES** and pins . . . **NEEDLES** and pins—
**COCHRANE** has the Sharps and the Thins!

Particularly the "hard-to-get" needles and sizes of Lane's, Bunnel's, Grieshaber, Kalt Corneal, Abscission, Adson Scalp, Adson Brain, Milliner #8—with no extra premium price tags attached.

**COCHRANE**
*PHYSICIANS' SUPPLIES, INC.*
133 E. 58th St., N. Y. 22—PLaza 3-5533 (4, 5)

**RADIUM**
**RADON**

SEEDS — APPLICATORS

THE RADIUM EMANATION CORP.
GRAYBAR BUILDING, NEW YORK 17, N. Y.
MURRAY HILL 3-8636

*"Pressoplast"*

**Natural or Flesh Colored**
Adhesive Cotton E-L-A-S-T-I-C Bandage
*"Contura"*—**BANDAGE**
skin protecting medicated
*Write for Literature and Reprints*

MFRS. OF ELASTIC BANDAGES AND DRESSINGS
*Medical Fabrics Co., Inc.*
10 Mill Street Paterson 1, N. J.

**METACARPAL and THUMB FRACTURES**

NEW TREATMENT NOW AVAILABLE

GOLDBERG METACARPAL SPLINT. A closed method of treating all types of Metacarpal Fractures including the Thumb.

*Write for Literature and Reprints.*

AMERICAN ORTHOPEDIC APPLIANCES
P. O. Box 31 Springfield, Mass.

**STRYKER Portable Suspension Traction Frame**

**For fractures of the femur in infants and children. Designed for Bryant traction and to simplify reduction. Fully adjustable for children up to seven years. Child can be taken home several weeks earlier.**

**ORTHOPEDIC FRAME COMPANY**
Kalamazoo, Michigan

**Colostomy and Ileostomy Patients**

find MORE convenience and LONGER service with

**PERRY APPLIANCES**

large variety of models and sizes CUPS, BAGS, PROTECTORS and IRRIGATORS, MANY FEATURES found ONLY in PERRY appliances' Write for folders showing complete line.

**MURLE PERRY**
3803 East Lake Street
Minneapolis 6, Minn.

**SPONGE BIOPSY FOR CANCER DIAGNOSIS**
(Method of Dr. S. A. Gladstone)

Sponge Biopsy is simple, rapid, painless, reliable. Sponge Biopsy facilitates diagnosis in the early curable stage of cancer of the cervix uteri,* rectum, oral cavity, skin, etc. Sponge Biopsy has received awards at the Scientific Exhibits of the N. Y. State Medical Society and the American Medical Association.

For best results use Onkosponge No. 1 and Gladstone Sponge Biopsy Forceps, prepared and designed especially for Sponge Biopsy.

*Write for descriptive leaflet and reprints.*

* Ref. Am. J. Surg., March, 1951.
J.A.M.A. April 21, 1951 p. 1238

**HISTOMED, INC.**
181 Lafayette Street Paterson 1, New Jersey

**FOR YOUR PROTECTION**

SOLE MANUFACTURER OF
COLLISON SURGICAL PRODUCTS

**SURGICALLY KLEAN**

3616 FALLS ROAD
BALTIMORE 11, MARYLAND
TELEPHONE
HOpkins 4575

*The Surgical Engineering Company, Inc.*

# Outside the Ivory Tower

(*continued from page 40*)

THE retirement of two prominent professors, one a surgeon and the other an engineer, was announced by Yale University. They are Dr. Samuel C. Harvey, Professor of Surgery in Oncology at the Yale School of Medicine, one of the nation's outstanding surgeons and a leading authority on cancer; and Roscoe H. Suttie, Professor of Civil Engineering in the School of Engineering, widely known for his work in sanitary engineering.

Dr. Harvey, in 1947, became the first U. S. and Yale Professor of Surgery in Oncology, that field of medicine dealing with tumors. He has had the twofold responsibility of stimulating Yale's widespread attack on cancer and training medical students and physicians in special problems of diagnosis, treatment and care of persons afflicted with the disease. In May, 1950, he was awarded the annual medal of the American Cancer Society in recognition of his long service in behalf of the battle against cancer and all aspects of medical progress. As early as 1931 Western Reserve University conferred on him the Honorary Doctor of Science degree for his important medical contributions.

THE Second Graduate Fellowship Program of the National Science Foundation, providing awards for study during the 1953–54 academic year in the mathematical, physical, medical, biologic and engineering sciences, was started early in October. The new program will follow the basic pattern set in the first year of operation. During the current (1952–1953) academic year nearly 600 NSF Fellows will receive advanced training in science under this program.

The majority of awards under the 1953–1954 program will be made to graduate students seeking master's or doctor's degrees in science although a limited number of awards will be made to postdoctoral graduates. Through the award of graduate fellowships the Foundation is increasing the nation's supply of trained scientists, thereby easing in some measure the severe shortage of scientists in most fields of science. After graduation many capable science students are unable to begin graduate training because of lack of financial support. In the award of NSF fellowships special emphasis is placed upon graduating college seniors who hope to continue graduate studies. NSF graduate Fellows are selected solely on the basis of ability. Candidates will be judged on their scientific aptitude and achievement as reflected in academic records and recommendations from individuals who are familiar with their scientific aptitude. Predoctoral applicants will take an examination designed to measure scientific promise and level of advancement.

Application forms for both predoctoral and postdoctoral graduate fellowships for the 1953–1954 academic year may be obtained from the National Science Foundation, Washington 25, D. C. Completed applications must be returned to the Fellowship Office, National Research Council, by January 5, 1953. The special examination for predoctoral candidates will be given at various places throughout the United States on January 31, 1953. Applicants will be screened by panels of outstanding scientists chosen by the National Academy of Sciences. Final selection will be made by the National Science Foundation. No awards will be made for study in clinical medicine although awards will be made to medical students interested in careers in medical research.

DR. BENJAMIN MINGE DUGGAR, who discovered aureomycin, was eighty years old on September 1st. He is considered one of the world's outstanding scientists. Born in Gallion, Alabama, in 1872, Dr. Duggar recorded his greatest scientific achievement after he was forced by state law to retire at the age of seventy-one from the staff of the University of Wisconsin where he taught botany. But the indefatigable Dr. Duggar was not content to sit in the shade and reminisce, so he went to Lederle Laboratories in early 1944 to join in developing penicillin and to take a hand in the new antibiotic drug research. Thus began one of the most inspiring stories in modern medical annals.

Penicillin was being produced by a large mold and Dr. Duggar wanted to search the smaller molds for other antibiotic drugs. Hundreds of samples of soil, where these molds are most plentiful, were sent to him at Lederle. Into the picture there came in due time teams which included chemists, bacteriologists, pharmacologists and other specialists who are important in experimental medicine. For three years, the scientists continued their tiring, plodding search, testing tens of thousands of

(*continued on page 44*)

# The Surgeon's Mart

*When you are in need of surgical instruments or medical supplies you will find the dealers and manufacturers listed below ready to serve you. For your guidance when purchasing supplies we submit this list.*

**STRYKER DERMATOME**

New convenience in skin grafting! Cuts grafts in 2¾" strips, any thickness, any length, from any part of body. Works most efficiently with Stryker Skin Tape. Sewing not ordinarily required. Motor and dermatome can be autoclaved as a unit. Quickly converted to bone saw.

**ORTHOPEDIC FRAME COMPANY**
Kalamazoo, Michigan

Close-Up of Eye Taken with New Exakta "VX" Camera.

New Model with Pre-Set Diaphragm Control

**35-mm. EXAKTA "VX"**

Single Lens Reflex Camera for Parallax-Free Surgical Photography

The Exakta, with both regular and telephoto lenses, is widely used in hospitals for operation room photography. Its unique through-the-lens viewing system assures absolutely correct "on the subject" photographs during every step of the operation. In addition, this world famous medical camera is regularly used for preliminary, developmental, and end result pictures of patients; for copying X-Rays; and for making color transparencies of injuries and lesions —a necessity for recording and lecturing.

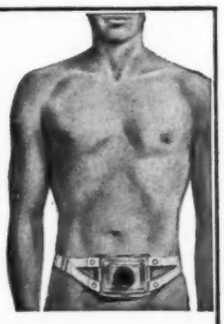
| | |
|---|---|
| With f2.8 Zeiss Tessar "T" Coated Lens with Pre-Set Diaphragm | $269.50 |
| Penta-Prism Eye Level Reflex Viewfinder | 50.00 |
| Extension Tube Set | 24.00 |
| Microscope Adapter | 29.50 |

Write Dept. 500 for free descriptive booklet "E" on camera and accessories and brochure on close-up technique with the Exakta.

**EXAKTA CAMERA CO., 46 W. 29th St., N. Y. 1, N. Y.**
Exclusive Sales and Service Organization in the U.S.A. for Ihagee Camera Works, Germany

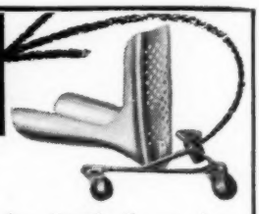
**NEW COMFORT NOW!**
**Deodorizing**
**Colostomy Protector**

Designed for patient's comfort. Deordorizes; saves embarrassment. No bag or cumbersome apparatus. Simple design; easy to keep clean. Refer patients or write for free descriptive folder and price list to:



ETNA Appliance & Equipment Co., Inc., Etna, N. Y.

**The PEABODY SPLINT**



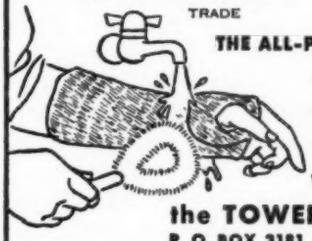
The Peabody Splint for excellent results in early post-operative exercise programs. Indicated for Arthroplasty by Prosthesis or in Smith-Petersen Mould Arthroplasty. Replaces Makeshift Board and Roller Devices.

Send for 124 page catalog

**ORTHOPEDIC EQUIPMENT COMPANY**
300 Ft. Wayne St., Bourbon, Indiana

**AIRE-CAST**
TRADE MARK

**THE ALL-PLASTIC CAST BANDAGE**



- It's light, strong, porous
- It's X-ray transparent
- It's unaffected by water

*Write for technics and prices*

**the TOWER COMPANY, Inc.**
P. O. BOX 3181 · SEATTLE, WASHINGTON

BRAND NEW GOV'T SURPLUS
**SURGICAL INSTRUMENTS**
and Medical Supplies

**AT 50% BELOW REGULAR COSTS**
all merchandise on approval
no payment unless perfectly satisfied
write for illustrated catalog L

**ARISTA SURGICAL COMPANY**
67 LEXINGTON AVE., NEW YORK 10, N. Y.

**YOUNG'S DILATORS**

Extremely useful in the treatment and prevention of contracted anus (particularly following hemorrhoidectomy), as an aid in perineal dissection and repair following delivery.

Sold only on prescription—at your surgical dealer or ethical pharmacy

Adult Set sizes 1, 1½, 2, 3—for stretching anal sphincter.
Children's Set sizes 0, 1, 1½, 2—for preventing contracted anus.
Size 3 and 4 drilled to take towel clamps—for use in perineal repair.

*Write for Literature and Reprints*

**F. E. YOUNG & CO.** 460 East 75th Street Chicago 19, Illinois

# Outside the Ivory Tower

(*continued from page 42*)

cultures, experiencing disappointment, then starting their search anew.

Then one day, an interesting, golden-colored mold appeared. This new mold was labeled A-377, a rather unexciting designation, and test tube experiments were begun immediately. The results were absolutely amazing! This new mold very effectively prevented the growth of staphylococci, streptococci and a variety of rod-shaped germs called bacilli. This latter observation was the most important, for while other antibiotic drugs were effective against staph and strep germs, here was evidence that this new mold was producing an antibiotic which might have a wider range of action against infectious diseases in man and animals.

The next step was to see if this new antibiotic, named Streptomyces aureofaciens by Dr. Duggar, could be isolated in a relatively pure, active and inexpensive form. Teamwork and patience, combined with modern equipment and the best technical skill available, soon proved that it was practical to isolate this new drug. Still more encouraging, early experiments showed that in reasonable concentration it was not toxic to animals. Laboratory tests continued at a rapid rate and soon it was learned that aureomycin had an effective range of action much greater than anyone had anticipated.

It was then discovered that this new antibiotic was effective against bacteria, certain large viruses and germs which cause typhus and typhus-like diseases. Lederle scientists also learned that aureomycin was effective when administered orally, eliminating the needle injection method usually used for penicillin. With all this information in hand, the scientists then began worldwide clinical tests of the new antibiotic and the results were startling. More and more uses for the drug were uncovered and documented. After more than a year of further tests, the scientists were ready to give the new drug their O.K. In 1948 the most versatile of all the antibiotic drugs was made available to doctors.

Despite all the wonderful progress that has been made in the last few years, the search for more effective antibiotic drugs for combatting diseases goes on night and day. And Dr. Duggar is still in this never ending search, working in his new laboratory seven days a week.

REAL sickness insurance for the American people is not to be found in the financing of medical services alone, but more importantly by guaranteeing a high level of training for professional personnel, concluded Dr. Willard C. Rappleye, vice president in charge of medical affairs and dean of the Faculty of Medicine at Columbia. "Much is being said these days about various forms of sickness insurance. This term is a misnomer," he said, "because it has dealt only with the economic aspects of medical services." Only by providing adequate education for physicians, dentists, nurses, public health and other personnel can we have "sound and progressive medical services in the future," warned the dean. "The key," he said, "must be adequate support of medical education and research."

Discussing current trends in medical education, Dr. Rappleye cautioned against overemphasis on the social and economic aspects of medical care at the expense of basic training in the biologic sciences, as advocated from some quarters. Studies in such fields as psychiatry, preventive medicine, rehabilitation medicine and medical economics are important, he said, "but they cannot be regarded as a substitute for the necessary fundamental training in the basic sciences upon which the future of medical progress, medical care and public service must depend."

A MEDICAL version of Stanford University's atom-smashing linear accelerator promises to put high energy x-ray treatment of deep-seated cancer within reach of every hospital in the nation.

The medical electron linear accelerator now being built in the university's Microwave Laboratory will produce an x-ray beam of approximately six million volts peak energy. Such a beam, unlike ordinary x-rays, will penetrate to cancerous growth deep in the body without injury to overlying skin tissues. In addition, the apparatus will be compact, flexible and relatively inexpensive.

Two research grants totalling $63,000 have been awarded for the project by the American Cancer Society and the National Cancer Institute of the United States Public Health Service, it was revealed today by Stanford President Wallace Sterling.

(*continued on page 46*)

# The Surgeon's Mart

*When you are in need of surgical instruments or medical supplies you will find the dealers and manufacturers listed below ready to serve you. For your guidance when purchasing supplies we submit this list.*


**SURGICAL INSTRUMENTS**

Specializing in the finest imported and domestic instruments.

(*Write for catalogue*)

**CAMPBELL CA ASSOCIATES**

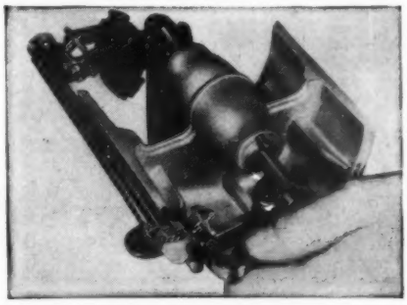
**918 Race St.** **Cincinnati, Ohio**

*Hansen-Street* **INTRAMEDULLARY PINS & INSTRUMENTS**

*Zimmer*

MANUFACTURING CO., WARSAW, IND.

*The Improved*



**PADGETT-HOOD DERMATOME**

*For simplified split skin grafting with real accuracy and speed*

- Inexpensive **THROW-AWAY** blades
- **DERMATOME TAPE** available for all models

*Write for complete catalog today*

**KANSAS CITY ASSEMBLAGE CO.**

816 Locust Street Kansas City, Missouri

THE GREEN JOURNAL

A Teaching Journal on Post Graduate Medicine

*Price:* $12.00 U.S.A.
$13.00 Canada
$15.00 Foreign

The American Journal of Medicine, Inc.

49 West 45th St. New York 36, N. Y.

**Disintegrating INTESTO-RING**

(INTESTINAL ANASTOMOSIS RING)

Surgeon can SEE and FEEL the progress of the anastomosis. Facilitates and increases accuracy of intestinal anastomosis. Disintegrates and discharged in 40 hours post-operatively. Contains barium sulfate for x-ray purposes. Available at your Surgical Supply House. Write for Literature. 5 sizes —14mm, 18mm, 23mm, 28mm, and 31mm.

(*All sizes are 25mm in length*)

**SEAL-INS LABORATORIES — 2857 East 11th Street Los Angeles 23, Calif.**

*Azochloramid*®

**Brand of CHLOROAZODIN U.S.P.**

*An Effective Anti-Bacterial Agent in*

**TRAUMATIC WOUNDS • DIABETIC GANGRENE**
**INFECTED ULCERS • DRAINING SINUSES**

*W&T Pharmaceutical Division*

**AZOCHLORAMID IN TRIACETIN 1:500**

For moistening dressings and packings

**AZOCHLORAMID SALINE MIXTURE**

To prepare isotonic saline solution 1:3300 for irrigation, hot soaks, compresses, etc.

1935 ACCEPTED COUNCIL ON PHARMACY AND CHEMISTRY AMERICAN MEDICAL ASSOCIATION 1952

Non-toxic to tissue — Virtually non-irritating. Non-staining — Odorless — Strongly deodorizing PA-11

W&T WALLACE & TIERNAN PRODUCTS, INC., Belleville 9, N. J., U.S.A.

# Outside the Ivory Tower

(continued from page 44)

Construction of the medical accelerator became feasible as a result of research financed by the Office of Naval Research. The ONR contracts put Stanford scientists to work developing linear electron accelerators for use in physics research as well as for medical and industrial applications.

DR. EUGENE H. PAYNE, one of the world's few men whose job is to plunge headlong into plague, has just returned from a six-month South American tour devoted to study of a subtle, little known killer.

In cooperation with the Peruvian government Dr. Payne of the Parke, Davis and Company clinical investigation staff conducted the first modern survey of intestinal parasites in the Andes Mountains region. Final results of the survey will not be known, however, until after an intensive study of the findings has been made.

Medical science is searching for means to break the deadly grip in which parasites hold their human "hosts." Dr. Payne says, "Internal parasites adapted for living in the human body are among the most highly developed of animals from the standpoint of environment. They must remain with a human being to survive.

"This means that the human race and their parasites have lived together untold centuries in order to build up this intimate and—for the parasite—necessary relationship."

TWENTY-ONE grants to aid cancer control projects in hospitals, medical schools, universities and other non-Federal institutions in twelve states and the District of Columbia have been announced by the Public Health Service of the Federal Security Agency.

The grants were made on recommendation of the National Advisory Cancer Council, a group of non-government scientists and leaders in public affairs. They will be administered by the National Cancer Institute of the National Institutes of Health.

Among the grants were several which support research for more effective methods of diagnosing cancer in its early stages, according to the Public Health Service.

"The need for a general diagnostic test for cancer is urgent," Dr. Scheele said. "Most cancers are still being diagnosed at an advanced stage despite the improvements in case-finding technics. A practical general diagnostic test for cancer would be of such great value in lessening the burden of cancer as a cause of illness and death that the Public Health Service is continuing to encourage studies in this field."

EVERY disease affects the whole human being, not just an individual organ, declares a Duke University pathologist.

For example, an enlarged heart does not result solely from the work of the heart but from the reaction of the whole body, says Dr. Wiley D. Forbus, chairman of the pathology department at Duke Medical School. An enlarged heart demands more food which is supplied by other parts of the body—not by the heart itself. And the heart may have become enlarged in trying to supply extra blood to some other damaged organ.

This "new highway" in pathologic thought is completed and presented in the second volume of Dr. Forbus' medical textbook, "Reaction to Injury," just published. Written in two volumes containing more than 2,000 pages, the book has been described as "a national and practical conception of disease that is essential to its prevention, diagnosis and treatment." Extensively illustrated, it is the milestone of some twenty years' work by the author.

A MARCH OF DIMES grant of $32,495 will enable scientists at Columbia University to investigate the changing of polio viruses in an attempt to immunize man against the disease. The grant was announced jointly by Basil O'Connor, president of the National Foundation for Infantile Paralysis, and Dr. Willard C. Rappleye, dean of the Faculty of Medicine and vice-president in charge of medical affairs. The project will be carried out in the Department of Pediatrics, the College of Physicians and Surgeons, and in Presbyterian Hospital.

Under the direction of Dr. Hattie E. Alexander, associate professor of Pediatrics at Columbia, a team of scientists will conduct research from two different approaches. The first will seek to change one type of polio virus into another. Other research will aim at growing one type of polio virus in the presence of a second, dead polio virus, in the hope of producing a virus with altered characteristics that could stimulate immunity but not cause injury.

# The Surgeon's Mart

*When you are in need of surgical instruments or medical supplies you will find the dealers and manufacturers listed below ready to serve you. For your guidance when purchasing supplies we submit this list.*


**POTENT ANESTHESIA**
**in Itching and Surface Pain**

**Via 20% Dissolved Benzocaine**

A rapid control of surface pain in many post-surgical conditions: Hemorrhoidectomies, episiotomies, amputations, removal of tape. Also to prevent pain in rectal and other examinations and instrumentation. Available "Clear" and "With Chlorophyll."

*Americaine*
TOPICAL ANESTHETIC OINTMENT

Send for FREE SAMPLES

ARNAR-STONE LABORATORIES, INC.
(Formerly Named Americaine, Inc.) Evanston, Ill.

**CHLOROPHYLL THERAPY**
***PLUS* BACTERIOSTASIS**

Containing water soluble derivatives of Chlorophyll "a" and Oxyquinoline Benzoate. To aid normal granulation of slow healing wounds and combat infections. Also for deodorization of malodorous lesions. Send for literature.

ARNAR-STONE
LABORATORIES, INC.
(Formerly Named Americaine, Inc.)
Evanston, Ill.

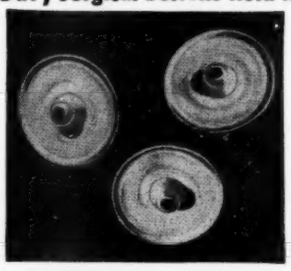
**CHLOROTHELIA** OINTMENT and SOLUTION

**THE PRIMER BANDAGE**
(moist,)
combined with
**THE DALZOFLEX BANDAGE**
(elastic adhesive)
SUGGESTED IN THE PRESSURE TREATMENT
OF
LEG ULCERS, VARICOSITIES
and other ailments of the extremities
where pressure is indicated

It costs no more to use the best
Catalog and price-list on request

*Medical Aids Inc.*
5 North Wabash Avenue Chicago 2, Illinois

**Davy Surgical Buttons Hold Retention Sutures Firmly**



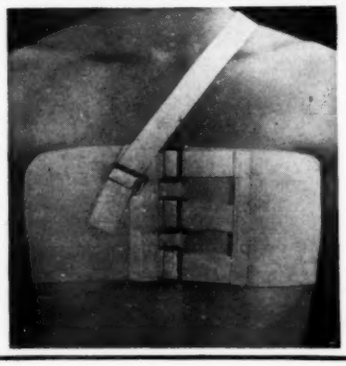
Non-Slipping
Less Scar Formation
Clean—Comfortable
Made of Aluminum
•
Excellent for Mastectomy as well as Laparotomy
•
FREE SAMPLES, upon request
At Your Dealers

**AMERICAN MEDICAL SPEC. CO. INC.**
12 East 12th Street New York City

**FRACTURE EQUIPMENT**
**Traction Apparatus, Finger Splints, Head Halters, Walking Heels**

*Catalog Sent on Request through Surgical Dealers.*

℞ RAJOWALT COMPANY
WARSAW, INDIANA



***ELASTIC* RIB BELTS FOR FRACTURED RIBS**

More comfortable and efficient than adhesive strapping. Made of the finest quality elastic webbing. Order through your dealer, or order direct with this ad. Delivered. Less 10% on orders of 12.

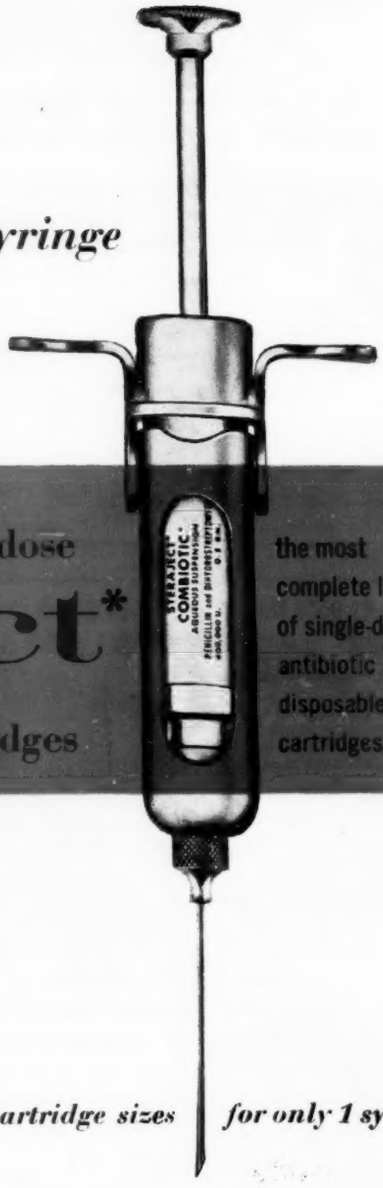
SHIP TO:

☐ Large Adult . . . $2.75 each
☐ Adult . . . . . $2.50 each
☐ Medium Adult . $2.25 each
☐ Child . . . . . $2.00 each

**LITTLE MFG. CO., BOX 202, WADESBORO, N.C.**

# NEW *Pfizer Steraject Syringe*

**holds 2 cartridge sizes**




sterile, single-dose

# Steraject*

disposable cartridges

the most complete line of single-dose antibiotic disposable cartridges

Steraject Penicillin G Procaine Crystalline In Aqueous Suspension (300,000 units)

Steraject Penicillin G Procaine Crystalline In Aqueous Suspension (1,000,000 units)

Steraject Combiotic* Aqueous Suspension (400,000 units Penicillin G Procaine Crystalline, 0.5 Gm. Dihydrostreptomycin)

Steraject Dihydrostreptomycin Sulfate Solution (1 gram)

Steraject Streptomycin Sulfate Solution (1 gram)

*2 cartridge sizes* | *for only 1 syringe!*

two cartridge sizes permit *full standard* antibiotic dosage

cartridges individually labeled

ready for immediate use

no reconstitution

*for full details, ask your Pfizer Professional Service Representative*

**Steraject Cartridges:**
*each one supplied with sterile needle, foil-wrapped*

*introduced by* Pfizer *world's largest producer of antibiotics*

*TRADEMARK, CHAS. PFIZER & CO., INC.

ANTIBIOTIC DIVISION • CHAS. PFIZER & CO., INC. • BROOKLYN 6, N. Y.

# The American Journal of Surgery

## ADVERTISERS INDEX

*December, 1952*


Abbott Laboratories ..... 8
American Cystoscope Makers, Inc ..... 20
American Hospital Supply Corp ..... 4
American Medical Specialties Co., Inc ..... 47
American Orthopedic Appliances ..... 41
Ames Company, Inc ..... 1
Arista Surgical Co ..... 43
Arnar-Stone Laboratories, Inc ..... 47
Austenal Laboratories, Inc ..... 11
C. R. Bard, Inc ..... 12
Bard-Parker Co., Inc ..... 26
Baxter Laboratories ..... 4
The Berivon Company ..... 21
The Burdick Corp ..... 38
Campbell Associates ..... 45
Chesebrough Mfg. Co ..... 24
Ciba Pharmaceutical Products, Inc ... *Back Cover*
Cochrane Physicians' Supplies, Inc ..... 41
Cook County Grad. School of Medicine ..... 35
Cutter Laboratories ..... 33
Davis & Geck, Inc ..... 25
J. A. Deknatel & Son, Inc ..... 39
Desitin Chemical Co ..... 27
Dome Chemicals, Inc ..... 39
Drug Publications, Inc ..... 36–37
Duke Laboratories, Inc ..... 26
Ethicon Suture Laboratories, Inc ..... *Insert Facing Page* 16
Etna Appliance & Equipment Co., Inc ..... 43
Exakta Camera Company ..... 43
E. Fougera & Co., Inc ..... 19
Gudebrod Bros. Silk Co., Inc ..... 18
Histomed, Inc ..... 41
Kansas City Assemblage Co ..... 45
Eli Lilly & Co ..... 32
Little Manufacturing Co ..... 47
Mallinckrodt Chemical Works ..... 13
Medical Aids Inc ..... 47
Medical Fabrics Co., Inc ..... 41
Merck & Co., Inc ..... 14, 28
V. Mueller & Co ..... 23
N. Y. Polyclinic Medical School & Hospital ..... 35
Orthopedic Equipment Co ..... 43
Orthopedic Frame Company ..... 41, 43
Ortho Pharmaceutical Corp ..... *Insert Facing Page* 24
Outside the Ivory Tower ..... 40, 42, 44, 46
Murle Perry ..... 41
Chas. Pfizer & Co., Inc ..... 48
The Radium Emanation Corp ..... 41
Rajowalt Company ..... 47
Schering Corp ..... 17
Seal-Ins Laboratories, Inc ..... 45
G. D. Searle & Co ..... 6
The Shampaine Co ..... 15
The Surgeon's Mart ..... 41, 43, 45, 47
The Surgical Engineering Co., Inc ..... 41
The Tower Co., Inc ..... 43
The Upjohn Company ..... 9
Wallace & Tiernan Products, Inc ..... 45
Winthrop-Stearns, Inc ..... 2, 22
Wyeth, Inc ..... 16, 29
Louis Yellin, Inc ..... 10
F. E. Young & Co ..... 43
Zimmer Manufacturing Co ..... 31, 45

*Whenever androgen therapy is required . . .*

# METANDREN® LINGUETS®

*"When administered as buccal or sublingual tablets, methyltestosterone was approximately twice as potent per milligram as unesterified testosterone . . ."**

*Liver is by-passed as with injection* . . . Metandren Linguets are therapeutically potent because they make possible the absorption of methyltestosterone directly into the systemic circulation. Placed in the buccal pocket or under the tongue, they are absorbed efficiently. Hence the body tissues become permeated with the hormone before hepatic degradation can take place. Metandren Linguets are supplied in strengths of 5 mg. (white) and 10 mg. (yellow) both scored.

Metandren (brand of methyltestosterone) Linguets (brand of tablets for mucosal absorption)

*Ferrandiz, R. F., and Gordan, G. S.: J. Clin. Endocrinol. 10:248, 1950.

**Ciba** a/1610 M